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THE

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OF

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EDITED BY

THEO. S. CASE.

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KANSAS CITY

REVIEW OF SCIENCE AND INDUSTRY,

A MONTHLY RECORD OF PROGRESS IN

SCIENCE, MECHANIC ARTS AND LITERATURE.

VOL. III. MAY, 1879. NO. 1.

GEOGRAPHY.

THE FRENCH EXPEDITION TO AFRICA.*

BY CAPTAIN H. W. HOWGATE, U. S. A.

Access to Equatorial Africa has always been more difficult from the western than from the eastern coast, and the burden of effort from that direction has fallen upon France, whose colonies on the west coast have given her especial interest in the subject. The expedition which terminated its work in 1878, after three years of labor, of suffering and of danger, had for its primary object the exploration of the principal river of the French-African possessions—the Ogoônè. It was officered by M. de Brazze and Dr. Ballay, who were assisted, in the early part of their work, by M. Marche, who had, on a previous expedition, added much to the knowledge of the course of this river. M. Marche was soon compelled to abandon his companions on account of the impaired state of his health, and they were left to push on without his assistance. Both M. de Brazze and Ballay were, from the first, sufferers from the malarial influences of the climate, but never wholly gave way. They had for escort twelve native soldiers of Senegal, in the French service, commanded by a subaltern named Hamon.

From the start the explorers were forced to struggle against the ill-will and cupidity of the blacks. This struggle was intensified as the distance from the

*Translated from the French for the REVIEW.

coast increased, and as they passed from one tribe to another, until at length it was transformed into open hostility.

The course of the Ogoônè can be divided into three nearly equal parts—the upper, the middle and the lower. The middle follows very nearly the equatorial line; the two others incline about a degree and a half toward the south; the one toward its source, the other toward its mouth. The baggage of the party was transported by canoes, and at times in the arms of the natives. The Inenga conducted the expedition to the middle portion of the river, where, reaching the territory of the Okanda, they refused to proceed further.

A first halt was made at Lopé, a large town upon the middle section of the river. From this point M. de Brazze made an excursion by land into the country of the Faus, with whom he established friendly relations. He went as far as Domnè, a point well advanced on the upper section of the river, where he was joined by Dr. Ballay in August, 1876. Here M. de Brazze, overcome by his long voyage on foot, was taken seriously ill. When he became restored to health he proceeded to collect in person all the articles of trade they had started with, for the purpose of obtaining with them the necessaries of life in the interior of Africa. This caused much delay, and he did not rejoin his companions at Domnè until April, 1877. When ready to set out the natives raised new difficulties. They accused the whites of bringing into the country dangerous maladies; demanded enormous prices for tranportation of baggage, and finally insisted upon a share of the merchandise itself. The situation was critical, and a collision was averted only by an expedient. They filled secretly a certain number of cases in such manner as to leave a stock of empty ones, sufficient in outward appearance to satisfy the rapacity of the natives. The full cases were taken off by Dr. Ballay and M. Hamon, while M. de Brazze, with some of the soldiers, remained behind and feigned a close guard upon the empty ones.

When he thought that his companions had reached the limits of the advance territory, M. de Brazze, with his soldiers, embarked in a canoe, and after many dangers, joined the expedition at the falls of Poubara, above which the Ogoônè is reduced to a insignificant stream of water.

The expedition might have terminated here, for the question as to whether the river afforded, as had been believed, a means of communication with the great interior lakes was decided in the negative.

But the courageous explorers were not content with this. After several day's rest, and in spite of their poor state of health, and the reduced condition of their supplies, they resolved in March 1878, to leave the basin of Ogoônè, and penetrate farther still into the interior. The last experiment they made here in the employment of the natives proved disastrous. They were twenty days in making ten kilometres, and several of their cases of merchandise were pillaged.

At this point they were driven to the purchase of a sufficient number of slaves to carry their effects, in order to free themselves from the exactions of the natives.

In this manner they traversed successively the territories of Ondonubo, of Umbèté, and of Baliki, when they made such diligence as to prevent the intended robbery of their baggage by the natives, with the assistance of the carriers.

After quitting the basin of the Ogoônè, the expedition suffered greatly from hunger and thirst, for the country traversed had been devastated by famine. A watercourse, N'gambo, running toward the East led the explorers to an important river, the Alima, which appears in geography for the first time.

This river is over one hundred yards in width with a depth of fifteen feet, and is doubtless one of the affluents of the Congo. M. de Brazze and his com-companions thought, however, at first that by following its course they would eventually reach the Atlantic, although its course at first led in a opposite direction.

They soon met with menacing demonstrations from the natives, which were soon followed by actual assault in which three of the party were wounded by bullets, and they were compelled in self-defense, to use their own weapons.

On the evening of the same day they arrived in sight of two large towns, one upon each bank of the river, and both full of enemies. Wishing to avoid a night combat upon the water M. de Brazze disembarked his party and intrenched himself. At break of day he was assaulted by thirty canoes full of natives, armed with muskets. The battle was short; the blacks were dispersed after having proved the superiority of European arms and skill.

It was not safe to persue the perilous route farther with so few guns and with such reduced force, and accordingly the explorers left the river, which continued to flow eastward, and moved toward the north, where they naturally expected less inhospitable treatment, but where, unfortunately, they found but few provisions. After having crossed several streams which flowed eastward, M. De Brazze sent Dr. Ballay and M. Hamon towards the Ogoônè, and alone continued his exploration to the Equator. It was an act of supreme heroism, as for five months he suffered hunger, fever and bodily pain.

He was finally compelled to return before the rainy season began, and, rejoining his companions, they descended the Ogoônè, and on the 30th day of November, 1878, reached Gabon.

In summing up this expedition it is seen that for three years, fifteen months of which were spent beyond the reach of civilized man, the explorers had to support great sufferings and to combat great dangers. They opened to the world an area in Central Africa previously absolutely unknown—larger than many of the smaller European States.

COAL DEPOSITS IN CENTRAL AFRICA.

A letter addressed from Livingstonia, under date of September 12, 1878, announces that a mine of coal has been discovered in Central Africa upon the borders of Lake Nyanza.

Mr. Rhodes, who accompanied Capt. Nelton in a combined hunting and exploring expedition, had reached the southern extremity of the lake, and thence proceeded along its western shore.

About a mile from the lake and twelve miles south of Florence Bay, he reached, in ascending a ravine, an elevated plateau of sandstone, in which, at an elevation of about four hundred feet above the lake, he found in the bed of the ravine, some little fragments of carbon. On continuing his investigations he discovered three distinct veins of carbon in the ground, one of which was not less than seven feet, and the other two from one to three feet in thickness.

SOUTH AFRICAN EXPLORATION.

Pinto, the Portugese explorer, telegraphs his arrival at Pretoria with eight followers left of the 400 with whom he set out on his expedition across the African Continent, from east to west. He reports he has saved all his papers, consisting of twenty geographical charts, many topographical maps, three volumes of notes, meteorological studies, drawings, and a diary of the complete exploration of the Upper Zambesi, with its seventy-two cataracts.

SELECTION OF AN INTERNATIONAL MERIDIAN.

A writer in a recent number of *La Nature* argues in favor of the establishment of an international meridian, and recommends for this purpose the meridian 10° east of Paris, which passes through Venice and near Rome (name so dear to history and so well known to geographers). He also proposes the establishment upon the island of Levanzo, through which this meridian passes, an international astronomical observatory, to be the common property of all civilized nations. For this purpose, it is assumed that the Italian Government would cede to the scientific world the control of this little island.

He also suggests that the United States cede, for the same purpose, a part of Oonalaska, through which the one hundred and eightieth meridian would pass. The two observatories thus established would be under uniform control.

AN AFRICAN HARBOR OF REFUGE.

In a recent discourse before the Scientific Association of France, M. de Lesseps explained his plan for the establishment upon the Niger, at a point in the great curve which that river makes toward the north, a place of refuge for slaves, which would also be a center of civilization in that benighted region, under the direction of the French section of the African Association.

This plan will probably form the first subject of discussion of a commission

which the Geographical Society of France proposes to form and which, composed of persons delegated by that society, by the African Association, and by the Society of Commercial Geography, of Paris, will occupy itself specially with the exploration and commercial development of the region comprised between Algiers, Tunis, Senegal and Senegambia.

BREMEN, March 10, 1879.

SIR: Herewith I have the honor to inform you that on the 15th of March I shall resign my charge as honorary secretary of the Bremen Geographical Society, and, remaining member of the council of the latter, shall transfer my residence to Gotha. I beg to direct all letters, journals, etc. for our society, from that date, to my successor, A. W. Wolkenhauer, Ph. D., Bremen, Besselstrasse, No. 29. Communications for me, I beg to send to

DR. M. LINDEMAN,

Co-editor of Dr. Peterman's *Mittheilungen*, Gotha, care of Justus Perthes.

GOVERNMENT SURVEYS.

The following is a summary of the Congressional action consolidating the several surveys made under direction of the Government, taken at the session which terminated March 4, 1879:

The Director of the Geological Survey, which office is established under the Interior Department, shall be appointed by the President, by and with the advice and consent of the Senate. This officer shall have the direction of the Geological Survey and the classification of the public lands and examination of the geological structure, mineral resources and products of the national domain. The Director and members of the Geological Survey shall have no personal or private interests in the lands or mineral wealth of the region under survey, and shall execute no surveys or examinations for private parties or corporations. The Geological and Geographical Survey of the Territories, and the Geographical and Geological Survey of the Rocky Mountain Region, under the Department of the Interior, and the Geographical Surveys west of the one hundredth meridian, under the War Department, are discontinued, to take effect on the thirtieth day of June, eighteen hundred and seventy-nine. All collections of rocks, minerals, soils, fossils, and objects of natural history, Archæology and Ethnology, made by the Coast and Interior Survey, the Geological Survey, or by any other parties for the Government of the United States, when no longer needed for investigations in progress, shall be deposited in the National Museum.

A commission on the codification of existing laws relating to the survey and disposition of the public domain is appointed, to consist of the Commissioner of the General Land Office, the Director of the United States Geological Survey, and three civilians, to be appointed by the President. Neither the Commissioner of the General Land Office nor the director of the United States Geological Survey shall

receive other compensation for their services upon said commission than their salaries, respectively, except their traveling expenses, while engaged on said duties; and it shall be the duty of this commission to report to Congress within one year from the time of its organization; first, a codification of the present laws relating to the survey and disposition of the public domain; second, a system and standard of classification of public lands; as arable, irrigable, timber, pasturage, swamp, coal, mineral lands and such other classes as may be deemed proper, having due regard to humidity of climate, supply of water for irrigation, and other physical characteristics; third, a system of land parceling surveys adapted to the economic uses of the several classes of lands; and, fourth, such recommendations as they may deem wise in relation to the best method of disposing of the public lands of the western portion of the United States to actual settlers.

The publications of the Geological Survey shall consist of the annual report of operations, geological and economic maps illustrating the resources and classification of the lands, and reports upon general and economic geology and palæontology. The annual report of operations of the Geological Survey shall accompany the annual report of the Secretary of the Interior. All special memoirs and reports of said survey shall be issued in uniform quarto series, if deemed necessary by the Director, but otherwise in ordinary octavos. Three thousand copies of each shall be published for scientific exchanges and for sale at the price of publication; and all literary and cartographic materials received in exchange shall be the property of the United States, and form a part of the library of the organization; and the money resulting from the sale of such publications shall be covered into the Treasury of the United States.

Copy of an act authorizing the Secretary of the Navy to accept for the purpose of a voyage of exploration by way of Behring's Straits, the ship Jeannette, tendered by James Gordon Bennett for that purpose.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of the Navy be, and he is hereby authorized to accept and take charge of, for the use of a north polar expedition by way of Behring's Straits, the ship Jeannette, owned by James Gordon Bennett, and by him devoted to this purpose; that he may use, in fitting her for her voyage of exploration, any material he may have on hand proper for the purposes of an arctic voyage; and that he is further authorized to enlist the necessary crew for said vessel for "special service," their pay to be temporarily met from the pay of the navy, and to be paid or refunded by James Gordon Bennett to the Navy Department under the order of the Secretary of the Navy and as he may require; the vessel to proceed on her voyage of exploration under orders and instructions of the Navy Department; that the men so "specially enlisted" as above shall be subject in all respects to the Articles of War and Navy Regulations and discipline; and that all parts of the act approved March eighteenth, eighteen hundred and seventy-eight, inconsistent with the above, be, and they are hereby, repealed: *Provided,* That the government of the United States shall not be held liable for any expenditure incurred or to be incurred on account of said exploration.

Approved, February 27, 1879.

ANTHROPOLOGY.

THE BIBLE NARRATIVE AND HEATHEN TRADITIONS.

Traces of the Facts mentioned in Genesis found in the Traditions of all Nations.

BY REV. STEPHEN D. PEET, EDITOR AMERICAN ANTIQUARIAN.

One of the most interesting subjects of modern study is the traditionary lore of the various races of earth.

There is a wonderful charm in these written and unwritten tales. They are not only poetical and beautiful but often very suggestive. In fact there is a depth of philosophy in them which has made them the subject of study to the most intelligent and thoughtful.

In the three-fold division of mythology, tradition and Folk-Lore, no department of literature is more important. It is, in fact, a department of science as well as of literature, and in its bearings on ethnology and the more general subject of anthropology, it is worthy of profound attention.

It is, however, almost a new and unknown department. Comparative mythology has, it is true, in times past, assumed considerable importance. Not only was this the case in the early days of the Christian era, when the mysteries of the cabiri were the subject of study among the learned, but even after the reformation, when Joseph Scaliger and other writers revived the occult subject.

Later, too, than this, the comparison of the classic mythology with the sacred narrative became a subject of study, and the Abbe Bannier, Jacob Bryant, the Abbe Pluche and others wrote at length upon the topic. Still later, Sir William Jones, in his extensive travels and by his familiarity with so many languages, became acquainted with the mythology and the traditionary lore of Arabia and the East Indies; and still later, the studies of Champollion and Sir J. G. Wilkinson, brought to light the ancient but long buried literature and mythology of Egypt and the regions on the Nile; and the translation of the Edda, and the publication of that charming book, Mallett's Northern Antiquities, also disclosed many delightful pictures, and wonderful myths among the Icelandic Sagas.

The Scandinavian mythology was found to be as poetical and as interesting as the classic, and, in fact, it was discovered that there was a wonderful similiarity between the mythologies of the distant East and the distant West, and that the same stories which had charmed the ears of the Orientalists in their warm sunny homes, were only repeated in the frost-regions of the distant North. If the language was different, the drapery of thought having been borrowed from the different surroundings, yet there seemed to be the same basis of fact.

It was afterward, however, discovered that the American races also possessed a wealth of traditionary lore which was as charming and as striking in its resemblances, as that of the Oriént or of the classics, and it was ascertained that the realm of comparative mythology was not confined to the Aryan race, nor even to the Eastern Hemisphere.

Students, as they read the Scandinavian and then the American myths, were surprised at their striking simiiliarity. Such was the resemblance that the reader was almost inclined to suppose that the Icelandic stories had been carried westward and repeated to the tribes of Aborigines by some pre-historic wanderers, or that some unknown intercourse between the two hemispheres had existed. Thus the volumes of "Algic Researches," by Schoolcraft, were found worthy a place beside the Norse Tales or even the writings of Homer.

Still later there appeared another development of the same great subject. The researches of that remarkable man, Brasseur de Brebourg, threw up before the notice of the civilized world, that wonderful waif of literature called Popal Voh, and it was found, that far to the southwest, among the half civilized races of Central America, there were myths and strange traditions which carried one's mind, not back to the Norse regions, but to the Orient; and again the resemblances between the traditions of the Eastern and Western Hemisphere surprised the students.

The depth and richness of American mythology proved remarkable, and there were beauties and wonders in it almost as striking as those of the Scandinavian or the classic.

It remained, however, for that learned Sanscrit scholar, Max Müller, to show the value of these various collections of myths. In his "Chips from a German Workshop" he has shown that comparative mythology is really as important in the study of mankind as is comparative philology. He has given a comprehensive sketch of the various religions of the East, with their earliest history and development, and has at the same time referred to the many works on the Folk-Lore and Nursery tales of other lands.

He has shown the value of history in bringing to light the earliest religious ideas of mankind, and yet has suggested the necessity of a philosophic and scientific study of the subject. He says, * "History with its dusty and moldering pages, is to us a sacred volume—as sacred as the book of nature. What compels men in the midst of these busy times to sacrifice their leisure to a subject apparently so unattractive and useless, if not the conviction that in order to obey the Delphic commandment—in order to know what man is—we ought to know what man has been."

Now it is this view of the importance of the earliest history of mankind in throwing light upon many of the great problems of science to which we would call attention.

The history of those distant ages and distant men assumes a new charm as

* Chips from a German Workshop, Vol. II, p. 8, article "Comparative Mythology."

soon as we know that it tells us the story of our own race, of our own family, nay! of ourselves.

Many things are still unintelligible to us, and the hieroglyphic language of antiquity records but half of the mind's unconscious intentions." Yet there are many things to be learned by comparing these mystic phrases, and it may be that we shall yet gain an interpretation of these earliest records which will throw a flood of light on the dark problem of man. Even these traditions and beliefs which were at the time not half understood, may in the light of later days, become significant of many important lessons.

There is a deep philosophy even in the unconscious workings of the human mind, and even fragments of thought are sometimes valuable as giving the key to the great arch which is so mysteriously being constructed. It may be that traditionary lore will yet prove to be a sort of universal language among the human race—a language not of words but of conceptions, and that these conceptions have become mingled with the earliest thoughts and views and practices of the various races, and then expressed themselves in their myths.

Nor does it matter whence these traditions sprung, whether from a common historical origin or from the inspiration of nature—the teachings of that great-good mother who teaches all her children alike. It is not essential whether we hold to the opinion of a nature basis for them all, or maintain the Historical origin; the resemblance of these traditions is really the point for us to consider.

We have in this essay, however, taken the position that these resemblances are evidences that there was a common historical basis or origin to them, and yet in taking this position we do not enter into a discussion of the subject with any controversial spirit, but with a sincere desire to know what is the truth.

The difficulty, however, is in the magnitude of the subject; no department of study involves a more extensive and more universal range of reading than does this.

To go over the many volumes which have been written on Folk-Lore alone is a formidable task, and yet no conclusion can be reached except as this field is thoroughly traversed. Max Müller has mentioned many of these, such as Kelley's Folk-Lore, Dasent's Tales of the North, Dasent's Deccan Days, Tales from the West Highlands, Popular tales from the North, Zulu Nursery Tales, and others, and has found in them certain traditions which could be explained on no othe resupposition than that of a common historic origin.

The number of books on this subject is, however, increasing rapidly, and scarcely a periodical appears but that mention is made of some new volume. The researches of antiquarians, the observations of missionaries, the testimony of intelligent travelers and explorers, are constantly furnishing new material.

It is said that Jacob Grimm was the first to mention the importance of collecting all that could be saved of popular stories, customs, sayings, superstitions, and beliefs, and his Dutch Mythology is a storehouse of such curiosities; but since his day it would seem as if every land had been searched for these strange

waifs of literature. Traditionary lore has been gathered from many of the most distant lands, and at the some time the customs of different races have been studied to see what traditional or what historical origin there was to them.

The simplest customs of modern days, such as dancing around the May-pole, the various religious and burial customs, have thus proved to be connected with tradition, and many of the symbols which are so frequently associated with religious forms have been traced back to very early times. The works on this subject are numerous and need to be studied.

There are also numerous books of travels, travels in Africa, in Siberia, Independent Tartary and among various wild tribes and uncultivated nations, all of which it is important to consult.

The works on comparative mythology are also numerous. Many of these are quite recent, such as "Cox's Aryan Mythology," and "Brinton's Myths and Myth Makers of the New World," and others, and yet the various Geographical and Geological Surveys are constantly gathering material for new works. In ancient history, also, a vast and increasing field opens before us, wherein we are to search for the original facts on which tradition is based. Not only are the ancient works of Herodotus, Diodorus Siculus and Plutarch to be consulted, but the later investigations of Rawlinson, Layard, George Smith, Gladstone, Grote and many others.

In the line of comparative religions there are also proofs on the subject, and the works of James Freeman Clarke, "Ten Religions" of Hardwick, "Christ and other Masters," and many others, need to be studied, as well as the older works of Davidson, Prideaux, Smith's Patriarchal Age and Warburton's Divine Legation.

Now, to sift all this vast mass of erudition, and to gather material from the many different departments of history, ethnology, mythology, and to say that we have arrived at definite proofs on this subject would be presumptuous indeed. Grote, the historian, bears witness to "the uselessness of digging for a supposed basis of truth," and Max Müller himself finds it very difficult to arrive at definite conclusions in reference to many of the myths and traditions even of the old world.

In studying the subject, however, we have not undertaken to trace the resemblance of all this vast and varied amount of material. This would be a task for a life-time. The largest part must necessarily be left in its own crude and unclassified condition, and other generations will need to trace the ethnological and the historical lines, or establish the ethnic philosophy which may account for the analogies and resemblances which so extensively appear. There has, however, been suggested to us a way of studying the subject which has at least been helpful and instructive.

It is well known that the Bible is the oldest book in the world, and in reference to the traditions of the ancient races at least, it is very instructive.

In reading the numerous volumes of that rare old work on comparative my-

thology, "Bryant's Analysis," it was represented that there were certain particular facts which were first recorded in the Bible, and which could be recognized in nearly all the mythologies of the East. and it occurred to us that possibly these same points or facts might also be traced in the traditions of other and even distant lands. We have confined our attention then to the earliest recorded facts of the Bible. It remains for us to show that these many resemblances of certain traditions among nearly all races to the scripture account can be explained on no other supposition than that of a common historic origin.

The scientific proof may be wanting, yet we maintain that the various cosmogonies contained in so many different traditions, the universal prevalence of a certain form of tree and serpent worship, the very common tradition of a deluge, and the various traditions of ancestral history and migrations, are all strong proofs that the same facts recorded in the Bible are the basis of the resemblances. We may call the Bible story an allegory, or believe, as Tyndall professes to, that it is a poem; or we may suppose that the processes of nature were the basis of the sacred record itself, yet the similarity of traditions in these particular points will need to be accounted for.

Now, taking into consideration the fact that these were the common inheritance of the Semitic nations of the East found in history, dug up in buried tablets, recognized in mythology, celebrated by poetry, repeated in many of the sacred books, and confirmed by many of the recent discoveries, it seems probable that they also might be transmitted through the lines of emigration, and preserved both by tradition and history in other and distant lands. The very discovery, then, of myths or traditions which bear a resemblance to these records of the East would certainly render the supposition plausible that the Bible itself, or the facts there recorded, were really the basis of these resemblances.

In taking this position we are not undertaking to prove or disprove the authenticity or the authority of the Bible as a religious book, but only as a matter of scientific investigation we consider ourselves at liberty to give this construction to the resemblance.

The cosmogony of the Bible may have been derived from a nature myth, and the serpent and tree may have been the natural objects of veneration and fear; the story of the flood may have been that of a local deluge, like others in other lands; the dispersion may have been an historical event; the confusion of tongues also an event which was inevitable from the growth of society and separation of families; the story of the fall and subsequent woes, and defections, and corruptions may all have been mere national and historical events which are recorded in the Bible in the familiar and yet reverential style; but the question still remains, how came the same facts to be so extensively recorded and by so widely separated peoples.

If these stories of a deluge, of a tree and serpent worship, and of the creation were so similar because each had similar experience, and there were local causes in each which would give rise to the resemblances, still we are at a loss to

explain why the coincidences should be so numerous and the resemblances so striking. The symbol of the ark and the tree and serpent, and the fish, and even the idols which commemorate these early facts are found too often for us to believe that there was not among the nations of the East at least a common origin for them all, and it yet remains to be shown whether the same symbols are not also to be found in other lands.

So, too, the names of the first ancestors among the ancient nations of the East are significant of the name of the first ancestor who is mentioned in the Bible.

It is not always the case that the record of these nations goes back of the flood, yet generally the head or founder of each nation bears a name which strikingly resembles both in the consonants employed, and perhaps even in the pronunciation, either the Adam or Noah of our Scriptures, and we may suppose all to have orally signified the same person. Among the Greeks, he is Inachus;* in Crete, Minos; among the Etruscans, Minerfu; in India, Tenu; in Egypt, Mna; in Germany, Mannus, and over each nation he bears the same relation as the head of the first dynasty, the first ancestor, and king, and the lawgiver, and in some cases he is called the great navigator and ruler.

Thus, as we enter upon the subject, we are confirmed by the testimony of history and the evidences of archæology, the symbols and records of the oldest nations bearing testimony for us.

It is then among these historical records that we shall seek for our evidences. Other authors have traced these, and Max Müller has gathered many of them into separate volumes of essays and reviews. It is probable that as to the Aryan race, and the various oriental religions, this assertion that the facts of the Bible may be recognized in them will not be really disputed.

Dr. Spiegel, the learned German editor and translator of the Zend Avesta has shown most conclusively that there is a coincidence. He maintains that this resemblance is found in the following particulars: the creation, the garden of Eden, the two trees, the deluge, Noah's ark, and the four ages of the world. The coincidence in the account of the creation consists in this: that the world was created in six days in Genesis and in six periods of time in the Avesta. In Genesis the creation ends with the creation of man; so it does in the Avesta. The Garden of Eden, and the Paradise of the Zoroastrians are alike, and the rivers Pishon and Gihon may be identified as the Indus and the Jaxarties, known to geographers of this day. The two trees in the garden are recognized in the trees known to the Iranians as the "Gaokerena," bearing the white Haoma, and the "Painless tree," out of which the Indians believe the world to have been created.

The deluge is also mentioned, and Dr. Spiegel compares the Thraëtaona of the Persians, who divided his land among his three sons, to the Noah of the Bible. He thinks also that the four ages of the Persians coincides with the four

Philip Smith's Ancient History, Vol. I, p. 85.

periods of the Bible chronology; that from Adam to Noah being the first, that from Noah to Abraham the second, that from Abraham to the death of Jacob the third, and that of the exile in Egypt the fourth.

Max Müller, in commenting on this view, while often doubting the conclusions of Dr. Speigel, yet shows the coincidences which may be found between these records in the Zend Avesta and the corresponding account in the still older book of the Hindoos, the Vedas.

The account of the temptation and the fall, the tree and the serpent, he acknowledges to be found both in the Avesta and the Vedas, but he maintains that the dualism of the Avesta, the struggle between Ormuzd and Ahriman, or the principles of light and darkness, is to be considered as the distant reflex of the grand struggle between Indra, the God of the sky, and Vitra, the demon of night and darkness, which form the constant burden of the hymns of the Rig Veda. He says, " neither in the Veda or in the Avesta does the serpent assume that "subtile and insinuating form which it does in Genesis. * * * But the serpent that beguiled Eve seems hardly to invite comparison with the much grander conception of the terrible power of Vrita and Ahriman in the Veda and Avesta. He says, also, " We likewise consider the comparison of the cherubim who keep the way of the tree of life, and the guardians of the *Soma* in the Veda and Avesta, as worthy of attention, and we should like to see the etymological derivation of the word cherubim, from the Greek word, *gryphes*, Greifen, and of seraphim, from the Sanscrit, sarpa, serpents, either confirmed or refuted." So, too, of the deluge he says: " It is not mentioned in the sacred writings of the Zoroastrians nor in the Rig Veda, but it is mentioned in the later Brahmans and the arguments of Burnouf, who considered the tradition of the deluge as borrowed from Semitic neighbors seems to us to be strengthened rather than weakened."

Fifty years ago the sacred books of three of the most important religions of the world were not known. It is said that Brahmanism claims for its adherents thirty-one per cent of the population of the globe

The sacred books of the Brahmans, the Buddhists and the Magians or disciples of Zoroaster have only become known since the knowledge of the Sanscrit has furnished a key to their translation. The discovery of these coincidences between the ancient writings of the Eastern nations and the Bible is most remarkable. "There is a high degree of interest attaching to their antiquity, for we seem to have not only the beginning of history but also the beginnings of intellectual life and of religious thought."

But leaving these sacred books of the East and their coincidences, we pass to the accounts of the same facts among the Western nations. Here we are met at the outset with the familiar myths of the Greeks, of the garden of the Hesperides with its fabled tree which bore the golden fruit, and of the dog Cerberus who guarded the tree, and it does not seem difficult to imagine that this was only another version of the same old story. The deluge of Ogyges and of Deucalion also remind us of the same story of the flood. Gladstone says, " Many elements

of the Hebrew tradition recorded in the Holy Scriptures, or otherwise preserved among the Jews down to later times, appear in the Olympian court of Homer. The traditions traceable in Homer which appear to be drawn from the same source as those of Holy Scriptures are chiefly these: (1) a deliverer, conceived under the double form, first of the seed of woman, and secondly of the logos, the word or wisdom of God. (2.) The woman whose seed the Redeemer was to be. (3) The rainbows considered as a sign of communication between God and man."*

He also says, "Certain special features are traceable most of all in the Athene and Apollo of the Homeric poems, but also in Zeus, and in Leto, and in Iris, as well as one or two other Olympian personages, and these features impart to the pictures of them an extraordinary elevation and force, such as to distinguish them strongly from the delineations of other gods.

The features in themselves are in the most marked correspondence with the Hebraic traditions as conveyed in the books of Holy Scripture."

It is very remarkable that in the Greek mythology these later Messianic ideas should have found a place in connection with these early traditions, yet there does not seem to be any doubt that the story of the garden, and of the woman, and of the seed of the woman, can be traced in the poetry of Homer. But it is probable that the advance of Jewish thought may have had its effect on these productions of the Greek mind which were so much later in time, and yet so near in geographical location, and, therefore, we do not dwell upon these coincidences referred to by Gladstone.

There is, however, a great contrast between the Greek mythology and the Scandinavian in this particular. The latest remnant of primitive heathenism is here found surviving the Greek and the Roman by nearly a thousand years, and yet for symplicity of the narrative and for striking resemblances to the earliest traditions nothing is equal to it. The story of the creation, and of the garden, and the flood as it is found in the Scandinavian myths furnish the most striking coincidences to the sacred narrative. It seems, indeed, like passing over a whole day of history thus to turn from the earliest book of the Vedas to the late date of the Eddas, and from the distant and warm region of the East to the frozen regions of Iceland and the North, yet the story seems to have retained its peculiarities in all its long wanderings.

Iceland was peopled and civilized by the Norsemen in the ninth century. The early emigrants were, however, Pagans, and Max Müller says that their religious system "may be called one of the various dialects of the primitive religions and mythological language of the Aryan race." (Chips from a German Workshop, Vol. II, p. 191.) He says, too, "There are passages in the Edda which seemed like verses from the Vedas." There are, also, several mythological expressions common to the Edda and to Homer.

Mr. Kelly has also drawn the parallelism between the Indian and the Iranian

*Inventus Mundi, pp. 207 and 274.

World tree, and the Ash tree, Yggdrasil of the Scandinavians, the same as Dr. Spiegel between Painless tree of the Persians and the Soma of the Hindoos.

We shall quote fully and literally from the translation of the Edda as found in Malletts Northern Antiquities.

"Many ages before the earth was made, was Niflheim formed, in the middle of which lies the spring called Hvergelmir, from which flow twelve rivers — Gjoli the nearest to the gate of the abode of death."

"But first of all there was in the southern region the world called Muspell. It is a world too luminous and glowing to be entered by those who are not indigenous there. He who sitteth on its borders to guard it is named Surtur. In his hand he beareth a flaming falchion, and at the end of the world shall issue forth to combat, and shall vanquish all the gods and consume the universe with fire. * * * Thus whilst freezing cold and gathering gloom proceeded from Niflheim, that part looking towards Muspellheim was filled with glowing radiancy, the intervening space remaining calm and light as wind-still air. And when the heated blast met the gelid vapour it melted into drops, and by the might of him who sent the heat, these drops quickened into life and assumed a human semblance. The being thus formed was named Ymir, but the Frost Giants call him Orgelmir. From him descend the Frost Giants." * * *

"Thus it is said that when Ymir slept he fell into a sweat and from the pit of his arm was formed a man and woman, and one of his feet engendered with the other a son from whom descend the Frost Giants. The sons of Bor slew the giant Ymir, and when he fell there rose so much blood from his wounds that the whole race of Frost Giants was drowned in it except a single giant who saved himself with his household. He escaped by going on board his bark, and with him went his wife, and from them are descended the Frost Giants." * * *

"Odin may justly be called the All Father for he is really the Father of All, of gods and of men, and to his power all things owe their existence." * * * In the beginning he appointed rulers, and bade them judge with him the fate of men, and regulate the government of the celestial city. They met for this purpose in a place called Idovöll, which is in the center of the divine abode. Their first work was to erect a court or hall, where there are twelve seats for themsevles besides the throne which is occupied by All-Father. This hall is the largest and most magnificent in the universe, being resplendent on all sides, both within and without with the finest gold. Its name is Gladsheim. * * That age was named the Golden Age. This was the age that lasted until the arrival of the women out of Jötunheim who corrupted them.

"Of Ymir's flesh was formed the earth; of his sweat (blood) seas; of his bones, the mountains; of his hair, the trees; of his skull, the heavens; but with his eyebrows the blithe gods built Midgard for the sons of men, whilst from his brains the lowering clouds were fashioned. * * * One day as the sons of Bor were walking along the sea beach they found two stems of wood out of which they shaped a man and a woman. The first (Odin) infused into them life and spirit; the second (Vili) endowed them with reason and the power of motion; the third (Ve) gave them speech, and features, and hearing, and vision.

"The man they called Ask, and the woman Embla From these two descend the whole human race, whose assigned dwelling was Midgard. * * *

"The ash is the greatest and best of all trees. The branches spread over the whole world and can reach above heaven. It has three roots. One of them extends to the Æsir, another to the Frost Giants, and the third stands over Niflheim and under this root, which is constantly gnawed by Nidhogg is Hvergelmir."

"This third root of the ash is in Heaven, and under it is the Holy Urdar-fount. 'Tis here that the gods sit in judgment." * * * "There is an eagle perched upon its branches who knows many things, and the squirrel named Rotatosk runs up and down the Ash, and seeks to cause strife between the eagle and Nidhogg. There are so many snakes with Nidhogg in Hvergelmir that no tongue can recount them."

INDIAN FIGURES IN WESTERN KANSAS.

BY PROF. S. W. WILLISTON, PEABODY MUSEUM, NEW HAVEN, CONN.

For many years the region of the headwaters of the Smoky Hill, Saline and Solomon rivers was a favorite hunting-ground for various tribes of Indians, who have left frequent indications of their picture-making propensities in the carvings scattered over the chalk cliffs. Most of them appear to be descriptive, but some were evidently allegorical and others humorous, or even obscene. The most conspicuous of any that I observed, in company with Prof. Mudge, was on the top of a high mound or hill on the south fork of the Solomon river, about due north of Coyote station. It was shaped as in the accompanying cut, and measured over sixty feet in length by nearly thirty in width, and composed of small cobble stones laid smoothly and evenly. Scattered about over several acres were a score or more of small mounds, built up of stones and not covering any graves.

The object in building these (and the labor had been considerable,) is very problematic; it may have been for amusement, but more probably some superstitious rite, the figure intended to represent some chief, for the sex was strongly indicated.

ASTRONOMY.

ONE ELEVEN-YEAR PERIOD OF SUN-SPOT OBSERVATIONS.

BY WM. DAWSON, SPICELAND, IND.

When viewed through a telescope magnifying about fifty times, the sun is a beautiful object. There must, however, be some means of protecting the eye from the intense light and heat. The best way I know of to do this, without much cost, is to place a kind of cap, having a hole in it about an inch in diameter, over the object-glass. Then put a piece of deeply tinted glass over the eye-piece, when you may look at the sun as comfortably as at the moon. With a six-foot

telescope furnished in this way, I began to make observations on the sun in March, 1867. For several days no spots were seen on the solar disk, but on the 7th of April I saw twenty small spots in three different clusters, or groups. In this observation I used a magnifying power of 200 diameters. And here I would say that a high power requires a larger aperture, or opening, in the cap. I have used a cap with several slides, having apertures for different powers. The slides are round and slightly fastened by one edge to the cap, so they can all be moved and thus get the right size.

With a power much above fifty the sun appears larger than the field of view in the telescope, and hence cannot be all seen at once. I looked at the sun every few days, generally with a power of 100, but saw no more spots till May 24th, when four small spots were seen in one group near the eastern edge of the sun. On the 26th several more spots were visible, two of them being larger and more prominent than the rest. They were also farther from the edge of the sun. By watching them day after day, I observed that they appeared to pass across the sun's disk from east to west—being a visible proof of what I had read, that the sun turns on its axis. One of these spots vanished near the sun's center about the 1st of June; but the other remained very prominent, and seemed very near the west edge of the sun on June 4th. Seeing that a spot traverses the solar disk (one side, or half of the sun) in twelve or thirteen days, we learn that he completes an entire revolution in about twenty-five days—the exact time being twenty-five days and ten hours.

My observations were quite frequent—sometimes every day—through the summer of 1867, and but very few spots were seen, often none at all. In the middle of September a group of fifteen spots appeared near the sun's center, but some of them soon vanished. One, the largest I had yet seen, was at the west edge of the sun on the 20th. It appeared long and narrow—as large spots always do at the sun's edge

Observations were not continued through the winter. On March 8th, 1868, five spots were visible, and on the 15th twenty-five had formed in two groups. Same number on the 18th, five of which were large and prominent, while several were so little as to be just perceptible. But a solar spot must be 400 or 500 miles across to be seen even as a speck. In four days they all had vanished—disappeared before reaching the sun's edge. On the 31st there were two distinct groups, one of them north of the sun's equator, the other south, both containing twenty-seven spots. Near a dozen of these were quite prominent, some of them encircled with a penumbra, which looks like a border surrounding the umbra (black spot). One of these spots was quite large, being of a sharp triangular shape at first, then oval, oblong, etc.

Throughout the months of April, May and June, 1868, from twenty-seven to thirty-four spots were visible nearly every day. For several days in the fore part of July the sun was clear of spots. Eight appeared on the 22d, and 30—all in one group—on the 25th. But few were visible in August or September. On the

22d of October there were ten spots in one group near the east edge, and a single one near the center of the southern hemisphere.

As yet I had seen but thirty-four spots at one time, and that more than five months ago; but now imagine my surprise and interest when, on the 29th of October, I counted 100 spots, with the 100 magnifying power—the one I generally used. Putting on a power of 200, with aperture increased to three inches, I counted 130 spots, arranged in ten groups, three of which were in the southern hemisphere and seven in the northern. I had never heard of more than 200 sun spots being seen at once; so I began to feel much interested to see if future observations would disclose to me a greater number. Seeing but *one* spot on November 8th, gave no encouragement in this direction.

By this time we realize a conspicuous change in the formation and disappearance of sun spots. Small ones sometimes form in a few hours, and vanish as soon. One day a group of little spots is seen; next day it is gone, and a group has appeared in quite another part of the solar disk. The spots in the same group change their positions, and large spots change in shape. And none of these changes are due to the sun's rotation on his axis. They would seem to indicate wonderful commotion and *great storms* on the solar surface.

On the 15th of November, sixty-eight spots in seven groups were visible. A number of observations were made through the winter, none showing more than fifty-four spots, which appeared in three groups January 28th, 1869.

April 7th, no spots visible. On the 11th a group had appeared with about sixty spots, two of which were quite large, but many of them too small and close to be counted with certainty, even with a magnifying power of 200. This power showed 191 spots May 10th. On the 22d but twenty were seen.

June 1st. Here is my number!—215 sun-spots visible to-day with a power of 200. 3d—225 spots in eight groups, one group having 120 spots. 14th—Only twenty-one spots to be seen. But on the 24th the 100 power showed 192 spots in thirteen groups. A power of 200 would probably have shown near 300 spots. I reckon this to be the climax for 1869, at least no subsequent observation showed nearly so many spots. Observations being less frequent during the winter months, it is possible that such a display might have passed unobserved.

After February 4th, 1870, observations were very frequent to the last of August—sometimes every day. The increase in the number and size of the spots was so great month after month that I always felt a wish to see and record the greatest display. Although the average increase in number was so much, yet the occasional disappearance or falling back in numbers was still prominent. Some examples (with power 100) are: February 10th, 1870, 107 spots; 13th, 100; 23d, 18; March 2d, 120; 18th, 154. No fewer than 100 were observed this month. On April 4th I counted 242 spots in nine groups, and on the 17th thirty-two spots were all I could see. On the 24th, 126 were counted. May 15th, 275; June 1st, 76; 13th, 86; 18th, 226; 19th, 349; 21st, 382; 27th, 472, one group having 275 spots.

These numbers were seen with power 100. I sometimes put on a power of 200 and could see about half as many more spots, and when the air was very good, nearly twice as many. But the display on August 27, 1870, exceeded any other that I have ever seen. The hundred power showed 640 spots; and with the 200 eye-piece I counted the astonishing number of 950 sun spots! and the air was not very good either; if it had been, I am fully convinced that *one thousand* spots might have been distinctly counted. There were fourteen groups, one of which had 340 spots; another, 300. But what a change soon followed! On September 11th, *thirty-one* spots were all I could see with power 100; On the 21st, I counted 460 spots in six groups; on October 23d, near 300 were counted in eleven groups. I perceived that the number was growing less, and partly through fear that so much intense looking at the sun might injure my eyes, I discontinued a regular count of the spots; but I still made frequent observations on the number and comparative size of the groups.

For many months the groups continued as numerous as they had been; but they were much smaller, and the number of spots not so great. But the spots occasionally appeared by the hundred for two or three years. For instance, August 17, 1871, there were nine groups; five were small, one large, and three very large—the number of spots being nearly 400. Again, May 5, 1872, fifteen groups, eleven small and four large, with about 200 spots. March 11, 1873, there were eleven small groups and one large group. May 20, 1873, my record reads: "One *little* spot on western side of the sun—the least show of sun-spots I have seen for several years." On May 6, 1874, were one small group and three large ones. In two days they were "three small and one large." April 4, 1875, "two or three little groups." July 22, 1876, "but few sun-spots lately." A few in 1877, though often none at all. About fifty observations were made in 1878, none showing any spots except those on February 6th, March 15th, May 21st to 28th, June 23d, November 3d and 22d, and the passage of a large spot, nearly 5,000 miles in diameter, across the the sun, from September 1st to 13th.

By this time we are forcibly struck with a very prominent and singular fact connected with sun-spots, namely, their *periodical recurrence,* which occurs about every eleven years. If my idea is correct that the maximum of the period just passed occurred about the last of August, 1870, it would seem that the time from minimum to maximum is much shorter than that from maximum to minimum; for, at many times in 1867 no spots were visible, by which I infer that to have been about the time of minimum, or least show of spots, and the beginning of another period, which probably has just closed, or is about ending. (Late observations show no increase of spots, but I am watching for them.)

This paper would be incomplete without a more definite account of the largest spots, many of which were visible to the naked eye (protected by a shade glass). The first one thus seen in this period, was on April 18, 1870. It was of an oblong shape, and, by careful measurement with a glass microneter of 200 lines to the inch, was 14,000 miles wide and 21,000 miles long, the penumbra

being nearly round, and 35,000 miles in diameter—near 1-24 of the diameter of the solar disk. The next spot seen without telescope was on May 15, 1870. On the 18th, two were visible, one of which the telescope showed to be composed of two separate spots. They were much smaller than the one seen a month ago. On June 6th, two spots were visible to the naked eye; another on the 27th, others on July 17th and 31st; one on August 18th; September 21st three spots were visible without the aid of a telescope; one of these was nearly 30,000 miles long and 12,000 wide. This spot had a very singular shape, which I have preserved in a small drawing. Two other spots were seen by the naked eye this year (1870), namely, October 23d and December 4th. In 1871, about twenty sun-spots were visible to the naked eye—sometimes three at once, on different parts of the solar disk. In 1872, but few were so observed—none after 1874. From a number of observations, I conclude that, to be seen with the naked eye, a sun-spot must be about 8,000 miles across. The large spots not only change in form and size, but sometimes divide into smaller ones.

A number of drawings were made from 1867 to 1871, showing the outline appearance of the groups and spots over the face of the sun. Occasionally a large spot is seen without any other one near it, but to see a little spot alone, is quite uncommon, there being nearly always three or more in a group.

The spots are nearly always found in the equatorial regions of the sun, being seldom or never seen more than half-way from the equator toward either pole.

I have not, in my observations, discovered anything bearing on the *cause* of sun-spots. Indeed, this is a subject not yet known to astronomers. The object of this paper being simply to give results of my own observations, the various theories which have been proposed, are left for another occasion, and perhaps a more competent writer.

ON SOME RECENTLY DETERMINED METEOR SHOWERS.

W. F. DENNING, F. R. A. S.

The following meteor showers comprise a few of the most important systems observed or deduced from the catalogues of foreign astronomers, by the writer, during the last three years. The number of meteors conforming to each center is given, and in some cases I have pointed out more than one epoch of intensity of the same radiant, (though not necessarily of the same shower). The aggregate number of meteors that I noted during habitual watches was 4513, (in 429 hours,) and 3213 of these were projected (as observed) on a globe of 18-in. diameter, the radiants derived, and the R. A.'s and Dec.'s of the paths read off and catalogued. In cloudy weather, and during periods of moonlight, I projected many of the meteor paths registered in the extensive lists of Heis, Weiss, Zezioli, Konkoly, and the Catalogue of the Italian Meteoric Association (1872). The number of paths thus examined and aligned was about 11,400. The star charts

used in this investigation were those of the British Association Luminous Meteor Committee, and many of the resulting radiants were found to coincide with those I had myself observed. For the most part they appear to be remarkable more for their long continuance than for transient intensity, and apparently comprise a different order to such condensed streams as the Perseids, Leonids and Andromedes. Several of the best showers, either new or but slenderly supported by other observers, are here pointed out as requiring re-observation during the last half of the year. I have not included already well investigated streams which have been more or less abundantly confirmed. To quote four examples:

	Pos'n deriv'd in 1876-8.	No. met's.	
Orionids . .	$91° + 17°$	147	Oct. 15-31.
Taurids I . .	$61° + 20°$	182	Oct. 12-Nov. 23.
Gemellids .	$110° + 24°$	82	Oct. 12-Nov. 20.
Geminids . .	$107° + 34°$	99	Nov. 21-Dec. 21.

The chief work of meteor observers in the future will be to determine the duration of these and other showers. Opinion is at present divided on the subject, for while theory teaches us that they cannot last but for a few nights, observation proves that they often continue for a month, and sometimes for two months.

The important question is, Are there any showers of such long duration, and, do they belong to one and the same stream?

1. R. A. $32°+53°$, (88 meteors,) July 20—Aug. 2. Maximum, July 30—Aug. 1. A very rich shower of short and swift streak-leaving meteors well seen in 1878. Heis gives a position at R. A. $37°+48°$, (37 meteors,) July 19—Aug. 2, which is probably identical. The meteors of this stream precede the Perseids of Aug. 10 (R. A. $44°+56°$), and is evidently a distinct system, though it has no doubt been mistaken for the major shower, and has given it a much longer duration than is really the case. There are a few of the true Perseids visible before Aug. 5 or 6. The new shower near x Persei may be termed Perseids II., and it is worthy of note that in Oct. there is another radiant at this point.

2. R. A. $341°—13°$, (54 meteors,) July 21-31. A well defined shower of rather slow, long meteors, without streaks seen in 1878. It had been previously traced by Tupman in 1869, July 27—Aug. 1, with a radiant at R. A. $340°—14°$, (61 meteors). This system forms a prominent shower at the end of July, (maximum 27-30, and in conjunction with the Perseids II. makes this epoch a special one for many shooting-stars.

3. R. A. $70°+65°$, (98 meteors,) July 25—Aug. 12. This shower was independently found by Heis and myself. It is close to the small star, c (Bode) Camelopardalis. Heis gives the center at R. A. $73°+63°$, and traced 152 of its meteors between Aug. 7-12.

4. R. A. $96°+71°$, (106 meteors,) Aug. 6-13. This shower and the preceding one were detected by the projection of more than 700 paths (directed from radiants eastward of the Perseids) in foreign catalogues, and was the chief

center indicated. It forms an active display, but had been overlooked by Heis and others, who had, however, recorded many of its meteors. The forerunners of this shower are visible at the latter end of July, and there is a radiant at the same place Oct. 28—Nov. 7.

5. R. A. 61°+37°, Aug. 6–12, (59 meteors); Sept. 7–15, (34 meteors); Oct. 20—Nov. 14, (43 meteors.) A series of active, well defined showers from a point below Epsilon Persei. The positions are severally confirmed by Heis, Aug. 12–19, at R. A. 64°+39°, (16 meteors); Zexioli and Tupman, Sept. 7–15, R. A. 63°+36°, and A. S. Herschel, Nov. 6, 1869, R. A. 62°+37°, (a fire-ball). It gives a fine shower of bright streak-leaving meteors at the middle of September. There is another shower at R. A. 62°+48°, apparently sustained for an equally long period, and showing a well defined radiant quite separate from the foregoing. No less than 193 meteors conform to the latter shower, and its chief activity is from Aug. 6–12, and Oct. 20—Nov. 13.

6. R. A. 306°+54°, (31 meteors,) Sept. 1. Meteors have often been observed to be numerous and brilliant on this date. A careful reduction of the observations has led to the determination of a strong radiant N. of Alpha Cygni. 15 of the 31 meteors conformable to it were of considerable brightness.

7. R. A. 102°+48°, (61 meteors,) Oct. 15—Nov. 13. Well observed 1877. The exact center is uncertain. There may be two showers here at R. A. 105°+51°, and R. A. 98°+45°, and more observations are required to settle the point. It is a rich radiant, giving very swift, short meteors in the mornings of October, and it again becomes a center of divergence on Jan. 1–15, Apr. 1–12. For the latter epoch, I find a good radiant of brilliant meteors at R. A. 106°+46°.

8. R. A. 142°+28°, (50 meteors,) Oct. 15—Dec. 12. On the mornings of Oct. 16–19, 1877, a few meteors (including one stationary) leaving bright streaks were observed from a point near Epsilon Leonis at R. A. 140°+28°, and the same point was amply confirmed on the two ensuing months by the directions of the meteor paths, in foreign catalogues. The maximum probably occurs early in November, and its meteors must be dis-associated from the Leonids. Schmidt is the only observer who had detected it before, for he gives a center at R. A. 140° +23°, Oct, 19–27, which is, however, 5° S. of the true radiant point. This stream is evidently of very long duration, and must not be confused with other systems close to it, at R. A. 132°+20°, (69 meteors,) and R. A. 120°+15°, (33 meteors,) which also appear to supply many shooting-stars during the last two months of the year

9. R. A. 43°+22°, (69 meteors,) Oct 20—Nov. 13. Maximum Oct. 31—Nov. 4. This shower vies with the Taurids I. in intensity and in the splendor of its meteors. It was traced by me in 1877, and described as a rich shower of bright, slow moving meteors, distinct from the Taurids, though very liable to be confused with them, for they come near together in date and place. Many large meteors have been seen during the first few days of November, and a projection

of their apparent paths show them to have been chiefly directed from this radiant point. Greg's shower at R. A. 43°+26°, Oct. 18—Nov. 14, is no doubt identical with this, but its importance has only lately been recognized. This may be the same as an October shower at R. A. 46°+27°, (25 meteors); and there is a display of long pathed meteors from the latter point, on the mornings of the early part of August.

10. R. A. 81°+23°, (53 meteors,) Nov. 22—Dec. 21. Maximum, Dec. 6. Taurids II. observed in 1876. The meteors are bright and slow moving. They were reöbserved by Sawyer, in 1877 and 1878. In September and October, this same radiant at Beta-Zeta Tauri is clearly indicated as a shower center of some importance, R. A. 80°+22°, (47 meteors,) and both Zezioli and Tupman traced it; the former at R. A. 84°+21°, Oct. 12–31; and the latter at R. A. 78°+23°, Sept. 8–10.

Bristol, England, Feb. 14, 1879. —*Science Observer.*

GEOLOGY.

ON THE ORIGIN AND FORMATION OF COAL.

BY PROF. E. L. BERTHOUD, COLORADO SCHOOL OF MINES.

The term, "coal," was first used in a restricted sense, meaning glowing embers of wood, then charcoal itself. To-day we mean by "coal" any mineral fuel that will ignite and burn with flame and incandescent heat, whose component parts are carbon, hydrogen, oxygen and nitrogen mixed with small amounts of earthly or mineral impurities; but in all the amount of carbon generally exceeds all other constituents of the mineral coal.

At first, in geological works forty or fifty years since, the "true coals" as they were called then, were supposed to be found only in the carboniferors formation—all coals found either below or above these "coal measures" were looked upon as either adventitious and accidental deposits, or, when found in formations above the "carboniferous," considered as "lignites." These arbitrary divisions have been found untenable, and to-day we know that true coal not only exists in formations older than the Carboniferous strata but also in the Jurassic, Permian, Cretaceous, and lastly in the Tertiary formations of such extent and magnitude as to exceed vastly in amount all the coal known to exist in all the strata beneath it.

Not proposing, in this lecture, to go into a chemical criticism on the subject of all the varieties of coal, I will simply state, that with many others I do not believe in the classification or appellation of our Colorado coal as a "lignite coal."

I think this is a misnomer which tends generally to cause many scientists east to condemn our coal for certain purposes, or even as a good fuel for heating purposes, from the misleading nature of this conventional name. Being found only in the Cretaceous and Tertiary formations lying at the foot of the Rocky Mountains, the first explorers of our Western Territories educated to compare our products, our minerals and our geological formations with European examples, and finding that in the Cretaceous and Tertiary formations of Europe, all mineral fuel found there, exhibited but a very slight change from the condition of woody fibre, and affording but an inferior fuel at the best, which is called there "lign.te," or "brown coal," they jumped at the conclusion that all our recent coals are nothing but "lignites," and therefore they cannot yield a good fuel fit for all the purposes to which coal can be applied.

I am happy, however, to s ate to my hearers that this assumption is for the most part gratuitous, and not founded upon strict fact or experience. Our coal formations at the east base of the Rocky Mountains are found immediately following the end of the Cretaceous formations, having been uplifted and subjected to intense pressure vertically and horizontally and to heat also; the original form of the simple deposits of vegetable matter, whether as peat or as annual plants or forest trees, or a mixture of all these together, have undergone full as great a change in quality as the coals of the so-called true coal measures or even the Anthracite of Pennsylvania, in other words we can call it a "Metamorphic coal."

For convenience, a division of mineral coals has been proposed, into three classes: "Hydrogenated" or "Coking Coals;" "Oxygenated" or "Non-Coking Coals" and "Hydrated Coals." Hydrogenated coals are such as form "coke" when properly heated in ovens, and derive this property from the presence of a large percentage of hydrogen; yet, if eight or ten per cent. of oxygen is present besides, it loses this quality. Pennsylvania and Ohio bituminous coals with Illinois coals form, in all cases good coke. Anthracite and our Rocky Mountain coal are not coking, while the Permian and Jurassic coal of Virginia is not only coking coal, but from the presence of intruded dikes of trap rock some of the beds are changed into natural coke.

Oxygenated coals, to which our Rocky Mountain coals belong, although affording an excellent fuel, yet, cannot be transformed into coke or pure carbon, for abounding in volatile ingredients the coal burns freely, but does not melt together and cake up as the hydrogenated coals uniformly do.

The term, "hydrated coals" is given to some varieties of mineral fuel that contain a large percentage of water. Even the anthracite of New England has been found to contain up to fifteen per cent. of water. Our Rocky Mountain coals, especially those that have not been exposed fully to heat and pressure, and found away from the mountains, contain a much larger amount of hygroscopic water than those we find uplifted and altered by internal heat.

That our coals in Colorado with the exception of Trinidad, and Gunnison River and White River coal, are all oxygenated coals is one reason why so little

success has attended all trials of such fuel for the manufacture of illuminating gas. To make illuminating gas requires hydrogen and free carbon in large proportions, hence an oxygenated coal cannot give good illuminating gas.

In addition to the above classes of coal we have Albert coal or Albertite, Torbane coal or mineral, Ritchie mineral and the White River Coal of Colorado. These several minerals of great value for gas purposes are more properly, like bitumen, asphaltum or solidified petroleum, to be ranked as coals. They are true hydro-carbons, forming a link in the sequence of Carboniferous minerals of which rock oil, petroleum and naphtha form different qualities, the other end of the carbon scale being Diamond, Graphite or Plumbago and Carboniferous Shale.

The formation of coal and the manner in which this mineral fuel under whatever shape we find it, has been deposited among stratified rocks is yet an unsolved problem. Though the coal measures of the world have for over a century, been studied and examined, and many well established points have been developed, it is as yet an unsolved problem of peculiar difficulty.

Some eminent geologists have established theories and argued on hypothesis founded on known present conditions of temperature, atmosphere and elemental action, thinking that all past processes and agents must, in the primeval age of the earth have been as now of like amount and effect. Others, however, with whom your lecturer agrees, consider that the past state and condition of the earth were very different from those of our present age, and found their reasons on scientific and geological facts no less evident than those holding their opinions from the deduction of the former theories. Altogether, the disagreement between the two classes is much in excess of their agreement on many undisputed points. We will now give an outline of a few of the more prominent theories of the formation of coal beds:

FIRST—The Drift or Raft theory.

This supposes that in those geological ages such as the Devonian, Carboniferous, Permian and Tertiary ages; the majority of the vegetation of the earth grew in wet swamps or low shores of lakes and rivers, or in the low lands of those periods; that this vegetation, torn loose and transported or drifted by waves and currents into shallows of the sea, or in lakes, was deposited on the bottom, thus forming, by continued additions, our present coal beds. All this presuming that vegetable matter thus sunk would not decay, and that the mud which invariably accompanies such drifting material would not mix with the submerged woody matter.

The advocates of this theory pointed triumphantly to the present immense accumulation of wood formed at this day in the delta of the Mississippi, and the Red River raft accumulation still increasing. If this theory were true, and the age of the delta of the Mississippi is as some claim, over 30,000 years; the first deposits of the delta would be "lignites." So far none have been found at the surface or by boring down hundreds of feet. This theory is now obsolete.

SECOND—Peat-bog theory:

That originally coal was composed not only of land-plants, but that large peat-bogs or marshes, slowly accumulating for centuries, were finally covered over and filled up by changes in level of the earth caused by earthquakes, or movements of elevation and depression; that thus covered by the sea, a succession of rocky or sandy or muddy deposits covered these ancient marshes and formed our coal basins; that several such alterations of level took place, each accompanied by a new coal deposit, to be in its turn covered again by the gradual erosion and dispersion of land formations caused by the action of the sea. Admitting the possibility that the growth of vegetation took place, as claimed in this theory, the alternate elevation and depression of the sea is too unnatural to be received as a geological fact.

THIRD—The Marine theory:

Supposes that the vegetation of the primeval world grew either in the sea as sea-weeds, or in shallow water; that their roots grew in the fire clay of the coal measures; that the water abounded in carbonic acid, or, even hydro-carbon; that a high temperature and greater internal heat was most favorable to plant-growth and caused great uniformity of seasons, while the atmosphere, redolent with smoke, steam and vapor, permitted but little effect from sun-heat; that, under those conditions, vegetation grew rank, profuse and of wondrous rapidity. Thus the presence of hydro-carbons, juices and sap was evoked to form coal in which vegetable fiber has only a secondary part. Prof. Lesquereux has advocated the theory that sea-weeds are the original source of the vast coal-oil deposits of Pennsylvania, and the United States, generally; that originally the vast sea-weed forests of the ocean were covered by deposits; that the effect of heat and pressure has transformed the cellular matter into liquid hydro-carbon.

FOURTH—Petroleum theory:

That when, as in the third theory, the beds of vegetable matter under water were subjected to pressure, the hydro-carbon oils would be squeezed out of them, then float on the surface among the growing plants, would aid to preserve them; this, becoming heavier from dust, mud, evaporation and oxidation of vegetation, would continually add to the volume of the coal-bed below the level of water. We think this theory is somewhat forced and of too refined a possibility.

The fifth and sixth theories are linked together under the name of Mineral and Volcanic theories:

In the Mineral theory it is attempted to account for and prove the formation of petroleum and its resultants coal and bitumen from chemical decomposition of water caused by the heat of submarine volcanoes and currents of hot, molten lava disengaging carbon, and that the petroleum or bitumen thus formed aided in the production of coal, although the formation of these two hydro-carbons did not require vegetable fibers for their formation. Messrs. Dadow and Bannan maintain this opinion.

The Volcanic theory, which is the last one, does not so much relate to the

formation of coal as to the manner in which the alterations of stratification in coal-fields were caused; but, as this covers nearly all known geological science, we will not attempt to give it in full. We may concisely state that all these theories contain elementary facts; that perhaps all the above causes cited may have had a part in the formation of coal, but that we cannot take any one theory and bring all the facts of coal formation deposits within the area of its hypothesis.

Ever since the existence of coal formations have been demonstrated to exist within several degrees north of the Arctic circle; that coal measures and accompanying fossils are found north of 66° of north latitude; that the existence of lignite beds in Greenland, Iceland and Spitzbergen, on Mackenzie river, in Alaska and in the circumpolar lands north of Behring's Straits, another difficulty has been added to the previous perplexing questions involved in the explanation of the formation and deposit of coal.

This is the question of terrestial temperature then and now, and how to account for the anomalies involved by the existing present state of the globe compared to its former state, when, from fossil evidence, we find palms, magnolias, pines, redwood, sassafras, sweet-gum and other trees growing formerly in Greenland, Spitzbergen and Iceland, when we find fossil shells and corals that require 66° mean sea temperature, now fossil on the Arctic sea-shore, and derived from carboniferous strata. These instances, and the direct proof that far within the Arctic circle once roamed vast herds of elephants, mastodons and wild horses, with animals akin to our buffalo, deer, musk oxen and domestic oxen, proves beyond doubt a change as vast in temperature as in animal and vegetable creation.

So, then, if we adopt Prof. Dana's theory of the presence in the water and atmosphere of an excess of carbonic acid and carbonic acid gas; that we, perhaps, in the Devonian and Carboniferous Ages had then a greater measure of internal heat from the as yet unadjusted and balanced cooling of the external crust of the earth; that the low elevation of the then dry land, the prevalence of vast sheets of fresh water in shallow lakes, the presence of and the tempering influence of great seas had a very material part in stimulating plant-growth; that their preservation and transformation into coal was aided by the presence, then, of great quantities of rich hydro-carbons, and the continuance, for untold ages, of this condition finally resulted in our present coal beds and coal measures. Willing, perhaps, to accept these as good, probable causes for the deposit of all coal measures known, yet this theory does not give us full conviction, as it asks us to accept tacitly a condition of terrestrial and atmospheric differences incompatible with our present known data of temperature, latitude and the seasons. In other words, it seems to ask our full belief in a past condition of things terrestrial, incompatible with all present known laws from which we must derive some points of analogy and comparison. asking us to accept the idea of an almost universal average of sub-tropical temperature as ruling the earth from the Devonian until the end of the Tertiary, and that, too, far within the Arctic circle, with no explanation of such assumption.

In some future lecture we will take up this subject and endeavor to reconcile these anomalies by including in our theory not only the coal measures of the earliest ages, but also applying to the latest Tertiary coal measures the same ratio of foundation.

GEOLOGY OF LA GRANGE COUNTY, INDIANA.

BY E. S. EDMUNDS.

II.

To write the geological history of a county so as to make it interesting to the scientific as well as the general reader, is a task that requires a great amount of study, together with critical and thorough investigation of the subject.

A professional geologist being acquainted with the structure of the earth's crust, and from "the testimony of the rocks," writes more boldly and perhaps with much less mental fatigue than the amateur, who, with cautious steps feels his way along through the various geological eras with the assistance of his boon companions—his books.

It is not a difficult matter to investigate and determine the rocks of any particular period, when they are disclosed plainly to view and the tangible evidence proves, beyond the shadow of a doubt, their identity. But, to judge of the underlying rocks when covered by a drift two hundred feet deep, is quite another thing.

The great problem, regarding the earth's growth, has puzzled the brains of mighty intellects, and is still a matter of much speculation(?). "Geology," says a noted writer, "is yet in its infancy." We realize the weight of this truthful statement, when we attempt to peer backward into the dark labyrinths of "chaos," and follow the history of our planet up through its paroxysmal struggles for existence to the present time. What, then, can be our conclusions when we find that the theory upon which we have based our fondest hopes, is crushed to atoms?

Notwithstanding the changes that are constantly taking place in the scientific world, we must acknowledge the opinion of the world's great leaders. Then, as geologists, we must accept the principles laid down by Lyell, Dana, Murchison, Agassiz and others, who have formed their theories upon close and accurate observations, backed by years of hard labor and care.

Beginning with the Mesozoic, or Mediæval, Age, we find many interesting fossils. Of this age, Prof. Dana fitly remarks: "The age of reptiles is especially remarkable as the era of the culmination and incipient decline of two great types in the animal kingdom, the Reptilian and Molluscan, and of one in the vegetable kingdom, the Cycadean It is also remarkable as the era of the first Mammals—the first Birds—the first of the common or Osseous fishes—and the first Palms and Angiosperms."

This age is divided into three periods; named in the order of formation: Triassic, Jurassic, and the Cretaceous or Chalk period.

It is presumed that the reader is cognizant of the origin of the above names, but, to make the point more plain to the general class of readers, I will explain the meaning of the terms.

The Triassic (triple), takes its name from the fact that in Germany it is composed of three distinct groups. The Bunter Sandstein or colored sandstone, the Muschelkalk or mussel chalk, a miner's term, meaning a group of red and green marls and shells. It is sometimes termed the new Red Sandstone, to distinguish it from the old Red Sandstone of the Devonian.

The Jurassic period derives its name from the Jura Mountains, on the western borders of Switzerland, one of the regions characterized by the formation.

The Cretaceous period derives its name from the Latin *creta*, chalk. The chalk, of England and other portions of Europe, is one of the rocks of the period. Says Prof. Dana, "The Triassic continent spreads westward to Kansas, and southward to Alabama. While on the east, the continent probably stood above its present level, through this period, and while, over much of the Rocky Mountain region, the land was barely emerging from the waters, or was covered by interior salt seas, farther west, over a large part of the Great Plateau, and the rest of the Pacific slope, the surface was washed by the Pacific and peopled with its life. The Sierra Nevada was then no barrier to the ocean; for the sands, mud, and limestone accumulated in those waters, constitute some of its rocks. The stratified beds of the mountains were then in the progress of formation, through the action of the Pacific tides, currents, and waves, and the growth of marine life. The making of the Sierra was delayed till the rocks of still another geological period had been deposited upon the Triassic."

The fossils of this period are not abundant in this vicinity. I will, however, mention a few only. Of the Cephalopods: the *ceratites nodosus*, a quaint-looking fossil, resembling more nearly a long, tapering worm rolled up into a wheel, the smallest part being rolled into the center. Specimens of the Orthoceras—similar to the Devonian type—are to be found occasionally. Ostracoids: *estheria minuta*, a very small shell-animal, which must have been an easy prey to the many monsters then inhabiting the Triassic Sea. With this small list of fossils, which is all that I have been able to identify, I pass to the Jurassic period. Its plants were mostly of the land and were mainly ferns, conifers and cycads, something like the Triassic. I have in my possession a fossil containing some of the stems of the ferns of this period.

The animal life of this epoch is quite well represented in the rocks of this region. Oölites sponge—*scyphra reticulata* were the most abundant of this family. Of the Polyp Corals of the Oölite, *Montlivaltia caryophyllata* and *Prionastraea oblonga*, two corals resembling somewhat the Polyps of the Devonian and Silurian periods. Of the Lamellibranchs of the Lias, the *Leptaena Moorei* and *Spirifer Walcotti*; and of the Oyster family of the Oölite, *Ostrea Marshii*,

Gryphæa dilatata—the former, Ostrea, is said to have been the progenitor of the common oyster, which bivalve is held in such great demand. The remains of Gasteropods, *Ammonites Humphreysianus*—similar to the Triassic fossils—are met with occasionally.

Of the sub-kingdom of Articulates, specimens of various worms, crustaceans, spiders, &c., are found. A crustacean, closely resembling the *Eryon Arctiformis* of the Oölite, is occasionally seen. This curious looking animal had a body something like our crawfish of to-day—with formidable pincers and a hard, bony-cased head. None of the larger class of animals of the Jurassic—Ichthyosaurus, Plesiosaurus and Pliosaurus, etc., are found, but, in connection with this period, I will describe briefly the above denizens of the Jurassic Sea. The *Ichthyosaurs*, (the name, from the Greek, signifying fish-lizard,) were gigantic animals, ten to forty feet long, having paddles somewhat like the whale. It had a long head, whose lower portion of which was armed with formidable-looking jaws, containing, in some species, two hundred stout, conical, striated teeth. This terrible creature also had an eye of enormous dimensions—in one species the orbital cavity being fourteen inches, in its longest direction—this eye, also, had a peculiar construction, to cause it to act both as a telescope and microscope, thus enabling the animal to descry its prey deep down in the water, and in the night as well as day. The length of the jaws was sometimes more than six feet. Its skin was naked, some of it having been found in a fossil state; its habits were carnivorous; its food, fishes and the young of its own species—some which it must have swallowed—were several feet in length. The *Plesiosaur* (the name meaning allied to a Saurian) had a long, snake-like neck consisting of from twenty to forty vertebræ, a small head, short body, with paddles similar to the *Ichthyosaurus*. Its paddles were proportionally larger than its prototype, no doubt for the purpose of greater speed in the pursuit of its prey. It was an inhabitant most probably of the shallow arms of the Jurassic Sea, where it probably used its long neck for seizing fish beneath, and perhaps flying reptiles above the water—of which there were many kinds.

Leaving the Jurassic, we enter the Cretaceous (Chalk) period, which is the closing era of the Reptilian Age. It is remarkable for the number of genera of mollusks and reptiles which end with it; and also for the appearance during its progress of the modern types of plants. This period is divided into two epochs—Earlier and Later Cretaceous. The rocks of this period "occur (1) at intervals along the Atlantic border, south of New York, from New Jersey to South Carolina; (2) extensively over the States along the Gulf border; thence bending northward along the Mississippi Valley, beyond the mouth of the Ohio, over what was then a great Mississippi bay; (3) through a large part of the western interior region, over the slopes of the Rocky Mountains, from Texas northward to the headwaters of the Missouri, and westward through Dakota, Wyoming and Utah Territories and the State of Colorado; along farther west, through some parts of the Colorado Valley, but not over the plateau between the Sierra Ne-

vada and the Wahsatch Range; (4) along the Pacific border, in the coast ranges west of the Sierra Nevada; (5) in British America,* on the Saskatchawan and Assiniboine; also, (6), on the Arctic Ocean, near the mouth of the Mackenzie, and in North Greenland. On the Atlantic border they are unknown north of Cape Cod."—DANA.

Although the fossils of the cretaceous are found in this locality, yet there are no rocks of this formation in considerable quantities nearer than Fort Dodge, Iowa, where it crops out prominently. Being of a soft nature, it is easily carved, and many beautiful ornaments are made. The station-house, or depot, at the above city is built of this material.

"The cretaceous rocks comprise beds of sand, marlite, clay loosely aggregated, shell limestone, or 'rotten limestone,' and solid limestone. They include, in North America, no chalk, excepting in Western Kansas, where, 350 miles west of Kansas City, a large bed exists."—*Dana.*

Judging from the fossils of both the fauna and flora of the cretaceous period, there seems to have been a decided change in the vegetation of the continent. While there yet remained the cycads (plants between the palms, ferns and conifers), of the Triassic, Jurassic, they were contemporaries of the "first yet known of the great modern group of angiosperms," such as the oak, maple, willow, and the common fruit trees indigenous to the temperate regions, inclusive of all trees having a bark but the conifers and cycads. Of the angiosperms, fossils of the *Sassafras cretaceum, Liriodendron meekii, and Salir meekii* are found.

Not wishing to dwell longer upon the flora, I will describe some of the cretaceous fauna among the protozoans of this epoch. The most important fossil is a rhizopod, *Orbitolina Texana.* This species are disk-shaped, closely resembling some of the nummulites. Under the sub-kingdom of molusks, the most common brachiopods are of the terebratula family, *Terebratulina plicato* and *Terebratula harlani.* The most predominant genera of samellibranchs are three of the oyster family, *Ostrea larva, Gryphaea vesicularis* and *G. pitchere*; also, another conchifer, *Inoceramus problematicus.* A limited number of the gasteropod family, *Pytifussus nerolerryi* and *Fasciolaria buccinoides,* are occasionally to be found. No fossils of the largest type of animals of cretaceous origin are found in this locality. Although this fact is apparent, yet there are some fossils belonging to this period that I think should be mentioned in connection with what has been stated before. Among the denizens of the cretaceous existed huge and formidable monsters—*Enaliosaurs,* or sea-saurians, belonging to the reptiles. These were exceedingly numerous. They were provided with flippers, with which they propelled themselves through the water with wonderful speed. One species of these animals, called by Leidy *Discosaur,* was fifty feet in length. It had a neck of over sixty vertebræ, measuring over twenty-two feet from one extremity to the other. The *Mosasaur,* a great swimming snake-like reptile, literally one of the "sea-serpents" of the era. Says Dana: "Remains of over forty American cretaceous

*It is quite probable that the fossils of the Cretaceous period, found in our vicinity, may have been brought in the drift from this locality (?) or at least some of them.

species of this tribe have been found—about fifteen in New Jersey, six or more in the Gulf beds, and over twenty in Kansas; and one of them, at least, *Mososaurus princeps*, was seventy-five to eighty feet long. The first one known was found in Europe, near the river Meuse, and hence the name. The body was covered with small, over-lapping, bony plates. The paddles, of which there were four, had the regular finger-bones of *man.*" Horrible thought! that we should have a characteristic of such frightful looking monsters as these lizard-demons of the deep!

I have only space to speak of one more of these terrible animals. The *Laelaps* was a powerful carnivorous animal, and the destructive enemy of the preceding smaller reptiles. A full-grown specimen was probably twenty-five feet in length. Its toes were long and slender, like those of a bird of prey. They were armed with flattened hooked claws ten or twelve inches long and adapted to grabbing and tearing. Its teeth were curved, knife-shaped, saw-edged, and fitted like scissors for cutting. The tail was long, rounded and strong, and capable of striking a blow or of throwing an enemy within reach of the kick or grab of the terrible hind leg.

What must have been the scene, could mortal eyes have gazed upon both land and sea during the Mesozoic Age? Prof. Stelle fitly describes it in his *Scenic Description* of the landscape of this age thus:

"It is an arm of the ocean, with broad, flat, muddy shores, at the bottom of which is gathering a sandy rock. The fog has just lifted, and discloses a view of surpassing beauty. On either hand the summits of the hills are crowned with lordly pines, while the sloping land is overgrown with palms and tropical trees. The shore is green with ferns and reeds, whose tufted tassels nod in the gentle breeze. No grass carpets the plain, no flowers embellish the scene, no birds sing in the trees. It is the reign of reptiles. On every hand they swarm—crawling, hopping, stalking by the shore. The water is alive with them—swimming, diving, and filling the air with an indescribable din. All day long enormous lizards crawl through the forests, crushing the reed-like trees before them in their headlong course, or plunge into the sea, leaving a broad wake like a steamer, while others, more fearful still, spread their wings and riot in the air. Sailing in and out among the shallow coves and bays of the coast, the plesiosaur, arching its long neck, eagerly watches a shoal of fish swimming near. But, with quick, sharp strokes of its whale-like paddles, the huge ichthyosaur darts into view, and glares upon its prey with its great bulging eye. Instantly the swan-neck disappears under the water, and the plesiosaur is hidden from its rapacious foe—the terror of the Mesozoic seas. Mighty dinosaurs, rivaling the elephant in size, stalk along the shore or squat on the beach, stupidly gazing on the scene, save when the lælaps, with fearful bounds, leaps among their frightened herds and tears them with his eagle-claws. But night draws on apace. In the dim recesses of the woods, the pterodactyle—that winged dragon so terrible to behold—sails slowly along on its broad leathern wings. As the shadows deepen, mighty sea-serpents

dart to and fro, battling with the rising billows; that huge bloated frog—the labyrynthodon—jumps by with great ungainly hops, while a tiny mammal,* the first of its kind, flies frightened to the shelter of the woods."

[*To be Continued.*]

CORRESPONDENCE.

RECENT FACTS FROM COLORADO.

(*Continued.*)

BY JOHN K. HALLOWELL.

EDITOR REVIEW:

After waiting for the Atchison, Topeka & Santa Fe train, which was two hours late, and came loaded with passengers the most of whom appeared to be determined to board the two small passenger coaches of the Denver & Rio Grande Railroad, we started—every seat filled and the aisles crowded with men standing. The ride to Cañon City must be interesting and novel to those unaccustomed to such scenery; but unfortunately for me, who wished to see everything, by the time we had got into the most interesting part it had become too dark to observe much. Arriving at Cañon City at eight o'clock, p. m., I turned out with the crowd and followed them about a mile, bringing up at the McClure House, which I found jammed full, the men mostly bound for Leadville; a few for Silver Cliff, and as near as I could learn only my solitary self for Rosita. After a good supper, and listening to the talk of the millionaires [prospective] with which the hotel office was crowded, I found, on inquiry for a bed that I was booked to share my couch with a member of the Colorado Legislature. Here was a new experience, but making up my mind that I could stand it if he could, to the room I went. I found Mr. H—— most entertaining, he having come to this country over twenty-five years ago as a U. S. soldier, and for twenty-three years never saw a railroad but knowing every one of any prominence, and I guess they all know him. At all events we found enough to talk about until two o'clock, a. m., and if Colorado is not any better for it, it is not our fault

In the morning we found a slight dash of snow had given everything the appearance of a fleece of wool. Here, at this altitude everything is light; the snow is light, ditto the rain, the atmosphere light, and much of the talk you hear must be set down in the same category, especially if it is about new mining camps, as it takes but little grain to give a large amount of chaff.

"Breakfast at six o'clock a. m. and the coach starts at seven o'clock a. m.,'

* "This was the *Dromatherium sylvestre*, the jaw bone of which was discovered by Emmons in North Carlina. It is the *only* mammal yet known to have existed in America during the Mesozoic Age"

was the information obtained from the urbane gentleman behind the office counter on the evening before. The hour came and so did the coach, seven passengers, six horses and the driver. At the suburbs of the town we met the Leadville coach returning—cause, bridge washed out, so they must stop over twenty-four hours. Just ahead was a party of three on horseback bound for Silver Cliff. They had started the night before, but ten miles up in the mountains, where a bridge ought to have been was a fierce torrent and the bridge gone elsewhere, and before they could turn around the road was washed out behind them, in which predicament they had to camp until daylight showed them the way out of the difficulty, and gave them the opportunity to get back to Cañon City and get a fresh start.

Straight for the nearest mountain we have started and an opening as to where we are to get through does not show. On arriving at the base of the hill a road is found graded up the side of it, and here the old stagers alight, and of course I was not going to ride when the rest walked. Here was the first call I had to test my "wind," and somehow or other before I was a quarter of the way up the ascent, I found my lungs were entirely to small for the quantity of atmosphere required in the exertion; but by stopping and giving them an opportunity to catch up, occasionally, I gained the point of the mountain where the road turns, ten minutes ahead of the coach. Such a grand, magnificent view I never before gazed on. A thousand feet down, at our feet, apparently, nestled Canon City, with the smoke of its hundreds of household fires curling slowly upward in the sunshine of a calm, glorious morning, all surrounded with a fleecy whiteness. Westwardly stretched the valley of the Arkansas with its chains of mountain summits guarding each side of it. Eastward were the broad, wide-spreading plains of Eastern Colorado. North, Pike's Peak with its summit of ice and snow reared aloft, looking so close that it appeared to be only an afternoon's walk away, but on inquiry I learned it was over forty miles from us. South, was hill and peak piled one against the other like the backgrounds to many pictures we have all seen—these were what we had yet to go over; up hill and down, but continually ascending. Thirteen miles out we stopped at the half-way house for dinner. From here the conveyance I was in went on to Silver Cliff, with the other six passengers, and I changed to the Rosita coach which met us at this place. The half-way house comes the nearest in situation and surrounding picturesqueness to the old illustration of the Notch in the White Mountains contained in the school geography I studied when a boy, of anything that my imagination can recall to memory.

Climbing to the driver's seat for companionship, we started, and two miles further on reached another house with a wooden sign over the porch, "Yorkville." Here a mail sack was left and our four horses changed for fresh ones. Six miles further we had gained the highest point of the road, and from that point to Rosita it was heavy wheeling through snow three feet deep most of the time; something that had not bothered us before. At this ridge, or divide, the road up Hard-

scrabble Cañon joins the Cañon City road; distance from Rosita to Pueblo, over the first fifty-one miles, over the latter, from Cañon City, thirty-one; either one well worth riding over to the sight-seer, and many in the summer season give preference to the Hardscrabble Canon route, but from the length of the ride I should think might be rather tedious. However, four o'clock p. m. saw me landed at the hotel in Rosita, with a mind fully alive to take in all of the facts to be picked up by a "tender-foot."

Rosita, a Colorado mining town, is pleasantly situated in a gulch with a southern exposure, overlooking the foot-hills and ranches of the Wet Mountain Valley, and a full, magnificent view of the rugged, sharp-pointed peaks of the Sangre de Cristo Range, whose sides appear now to be covered with snow from foot-hill to summit. The fixed population of Rosita is about 1,000 to 1,200, and the floating population hard to estimate at present, but constantly increasing. Nothing is raised here, so that the grocer is the most important factor in the population. Prices are very reasonable in consequence of the proximity of railroad communication. Hayden, in his report of 1873, speaks of Rosita as a mining camp just started; he visited it and gives the elevation as 8,827 feet. Subsequent elevations taken in the neighborhood of the post office make the elevation 300 or 400 feet less, which difference can easily be accounted for, as a half mile further up the gulch would certainly make that much difference in altitude. Hayden mentions the mines as situated in a formation of "Rhyolitic" granite, while on referring to Reymond's report for 1876 a communication therein states that the mines are situated in a belt of porphyry of from three to five miles in width, and in this belt the most productive lodes have been discovered. As near as I can make out the belt runs in a general east and west course, and is traversed its whole length by dykes of syenite and quartz, the latter carrying the mineral in veins, pockets and chimneys; also many cross-lodes occur, apparently radiating in all directions from the loftiest summits within this belt. This is not yet proven as a fact, nor is it yet proven in which course lie the richest mineral veins, although, personally, I have a belief that those following a general east and west course will eventually prove the most permanent and most productive as to quantity.

The camp was located in 1872 and made a good start, but the panic of 1873 in the eastern cities effected mining enterprises as well as everything else. Following the panic came the San Juan rush, then the Black Hills fever and now the Leadville epidemic is in full blast; but part of the overflow of people has been caught at Silver Cliff, about seven miles west of here, where there are some most excellent mines. In consequence of these other discoveries I do not think Rosita has seen her best days yet by any means. Her time is yet to come; but when she does come to the front she will come to stay. North of the town proper, for about three miles square, the ground at a glance, would appear to have been well prospected, from the number of holes dug; but most of these were worked from two to six years ago. Now, recent developments in mining

for the precious metals show that old ground can be gone over again by prospectors, and what was considered worthless then, may now be of great value. It is in just such parts of the country as this, that the men who put in a few hundred dollars at the time when it is attracting the least attention, eventually reap the greatest returns for their investment. Rosita has these advantages: a situation, in what has been proven to be a rich mineral belt; proximity to supplies and transportation; winters so mild, that generally, out-door work can be done at all seasons; old enough to have a civilization and settled population. What is wanted now, is the attention of and investigation by capitalists, or experts representing them.

There are several miners here working and shipping ore. By the time for another issue I will endeavor to have some facts regarding them, that I trust will be of interest.

ROSITA, COL., April 1, 1879.

SPRING IN THE ROCKY MOUNTAINS.

GOLDEN, COLORADO, April 8, 1879.

EDITOR KANSAS CITY REVIEW OF SCIENCE:

April 3d to 5th I spent in the main central range of the Rocky Mountains west of Gray's Peak, about in latitude 39°, 38′ north, longitude 105°, 53′ west. My altitude (all deduced from spirit level heights) was from 10,130 feet to 11,900 feet above the sea. The main valley runs in an east and west course; the side valley, which leads to an abrupt, sharp divide between the waters of the Atlantic and the Pacific, which is the main crest of the great Rocky Mountain range, called Loveland Pass, is selected as the best location for crossing the Rocky Mountains with a railway line to the promised land of rich carbonates, called Leadville, Carbonateville, and Ten-Mile Valley.

We have had a permanent camp in the main valley since March 25th, just where a fine little glade or open park, fringed with pines and spruce, spreads itself at the northwest foot of a mountain, called the "little Professor," some 13 000 feet altitude

Contrary to all we expected, we find a surprising and agreeable temperature all day long. Scarcely a breeze moves the graceful foliage of the spruces and Canada balsams. The snow lies on the north slopes from three feet to eight feet in depth; on the south slopes and the edge of the park, we find abundant bare ground, while on every side the melted snow trickles under the crust in thousands of rills, and swells daily the small brook that occupies the centre of the valley. When Horace sang:

> "Solvitur acris hiems,
> Grata vice veris et Favonii,"

he could not have described more closely the effect that a southwest wind causes

by its genial influence. The dormant energies of vegetation seem suddenly to act with extraordinary vigor. Our low mountain willows still buried, in many places, two feet deep in soft snow, have formed already their dense white catkins covered with a soft, woolly inflorescence. The alder shoots out its rusty, red flowers, and the mountain birch (*Betula resinosa*) swells its buds and catkins with a vigorous growth, while lower down the valley, at 10,000 feet altitude, the hairy anemone with purple hirsute flowers, peeps out of the mellow sunny banks in tufts of many heads. The *Arbutus uva ursi* (Killikinick), grows green and vigorous, with numberless flower buds.

Ascending the south valley the snow increases in depth up to eight to ten feet on the mountain slope. Where shaded by *Pinus anstcta*, *Abies canadensis* (balsam fir), and white spruce (*Abies alba*), its great bulk is yet but slightly reduced by a brilliant, fervid sun, and a heat at one o'clock P. M., of fully 85°. Ascending to the summit of the range over the just graded track of the Georgetown and Snake river wagon road, I find the twin flower (*Linnæa Borealis*), wherever the ground has been shoveled bare of snow, it is growing thriftily and full of new flower buds, even up to 11,300 feet altitude; while with its fescue-grass (*Favina*,) *Pyrola*, and *Vaccinium*, are everywhere growing rapidly. Every patch of ground is teeming with new life, while flies and butterflies buzz and flit in every direction. Continuing my ascent, after crossing a vast snow-field between 11,400 and 11,900 feet altitude, the summit of the mountain is revealed, bare of snow for a long distance on the south and west slopes; its countless variety of grasses and mossy flowering plants just starting into life. Here the *Silenes*, *Arenarias*, *Saxifrages*, *Gentians*, *Sibbaldias*, *Drabas*, *Crepis*, *Myosotis*, *Eritriclunis*, *Mertensias* and *Ranunculi*, are giving faint indications of the end of that long sleep that begins in October and continues until May. In six weeks time we will find them in vigorous growth, and by June in the glory of florescence, rivaling in brilliancy the rays of that sun whose heat forces them into rapid growth; but of short duration and still more rapid maturity.

The summit of our snowy range in many respects, is akin to Greenland or the Arctic circle; not only in its *flora* but in the animal world that is developed in those lofty isolated summits. We find the birch and willow dwarfed into shrubs, only three or four inches high; while the countless variety of flowering plants are mere diminutive mosses, hardly one inch high, spread in circular patches in sheltered nooks. We find here a lovely *gentian*, three-quarters of an inch high, with fully developed stem, leaves and flower. A real vegetable pigmy.

Accompanying the rapid changes of the whole plant growth, we find in the lower valley a renewal of the activity of animal life. Chipmunks of two varieties; a handsome gray pine-squirrel, and the black squirrel with tufted ears (*Sciurei aberti*), are roaming over the pine trees. The white arctic hare, the tailless marmot field mice, small yellow-foxes, mountain wolves, the wolverene (*Gulo*), mountain sheep, and a handsome pine marten, are not infrequent. Of birds, we

find in the summit of the range: Ptarmigan, (*Lagopus leucurus*) pine grouse, ground sparrows and small, reddish hawk; in the valleys: moose birds, cerulean jays, blue birds and sparrows and an occasional robin, with the ever-present, mischevious magpie, while a little horned owl is first seen three miles below our camp.

Truly, we can say, the rule of old "Father Winter" is broken, the birds, the animals, are fast forming new ties, new homes; all nature teems with renewal; all breathes new life and a continuation of that struggle, which, if not strictly the survival of the fittest, is at least an indication of the renewal of vital force, an effort to maintain the balance between the active and passive forces of creating nature. I am inclined to believe that this, to us, so precocious an exhibition of the effect of returning vigor and growth, cannot alone be ascribed to the power of the sun's direct rays; it must be joined to an evolution of internal heat, stimulating plant growth, apart from the action of the sun which cannot, I am persuaded, act so energetically through three or four feet of snow as to bring out our willows in full inflorescence. E. L. B.

SCIENCE LETTER FROM PARIS.

PARIS, March 16, 1879.

Sixty years ago, Sir Humphrey Davy took two sticks of charcoal and pared them to a pencil point; he connected each of them with a powerful electric battery; soon the sticks became red; placing them wider apart, a luminous jet of light, of a convex form and very dazzling, was generated. This was the Voltaic arc, and the origin of the present system of electrical illumination of large buildings and public squares. Ten years ago a focus of electricity was but a curiosity; it was viewed as a luminous aigrette, flashing from the summit of a building in space like the tail of a comet. To-day this electric light is utilized instead of gas in many theaters, railway termini, markets, public squares, galleries and court-yards. Recently the Prince of Wales visited the printing-office of a leading journal in this city, and was preceded by employès carrying "electric candles." Davy's discovery must be ranked among the most beautiful applications of science. It was in 1817 that Mr. Winsor, an Englishman, experimented with coal gas in Paris; two years later, the city had no less than ten companies—all now amalgamated, and where Englishmen occupy, hereditarily, the chief practical posts.

Returning to Davy's experiment, the electric current passing between the two carbon points effects a veritable change of matter: one of the points wears away incessantly, while the other, enriched by the loss, becomes enlarged. The sticks, slowly burning, engender such an enormous heat that platinum melts in the arc like butter. The brilliancy of the light depends on the interval maintained between the charcoal rods—these must be continually brought nearer to

each other, in order to secure an equal light. To secure this necessary interval a regulator was invented, worked either by the electric current or a clock movement. Another improvement consisted in the use of a superior form of carbon; but the most practical ameliora'ion was the invention of a machine to generate continuously, currents of electricity. This mechanical production of the fluid, without a pile, was based on a singular phenomenon observed by Faraday in 1832. When he brought a piece of soft iron into contact with a magnet around which was wound a coil of copper wire covered with silk, there was an instantaneous current of electricity developed in the wire, flowing, in one sense, at the moment of contact, and, in a contrary, at the moment of removal. This discovery has been ingeniously applied in the Bell telephone. It sufficed then to turn such a coil before a piece of iron in order to obtain electric currents. This is exactly how electric lamps and candles are fed at present, the magneto-electric machine being turned by a little engine. Thus was dispensed with the complicated and costly batteries of bottles, acids and deleterious vapors of the laboratory. In many factories the electric machine is worked by a connection with the ordinary motive power.

For measuring the intensity of light, a carcel lamp in full power, consuming about 1¼ ounces of colza oil in an hour, is taken as unity. Now, the Voltaic arc of Davy, condensed to a point, is too dazzling; it equals, in intensity, several hundreds of carcel jets—it is a morsel of the sun. M. Fitzleau estimates, that, tested by its photographic effects, sun is three-fifths stronger than electric light, and M. Allard calculates that the Voltaic arc is six hundred times more intense than the jet of the carcel lamp. To obtain the intensity of some of these electric arcs of light, it would be necessary to burn, in a vessel, one hundred and seventy pounds of oil in an hour, or consume, during the same period of time, the quantity of gas contained in a balloon having a diameter of thirty feet. Such a quantity of light concentrated on so small a point was inconvenient—it pains the eye. M. Plateau, of Brussels, lost his sight for having too long time observed the effulgency of the electric light during his experiments. The next difficulty to surmount was to distribute the light, to divide this brilliant point or focus, and hang up at various distances on walls, like jets of gas, the luminous morsels as stars. The young Russian engineer, Jablochkoff, has solved the problem. He places two sticks of carbon parallel-wise, soldering them with a special cement; this causes the electricity to flash at both the points of the carbon—the heat instead of consuming the sticks volatilizes the cement, just as the wick does the grease of a common candle. This is the "electric candle." The carbon employed is very pure, so as not to affect the quality of light, and is prepared from graphite and sugar. The electric machine can thus have its currents divided, in being distributed over several candles at once. The light thus produced is very beautiful and admirably fixed. M. Jablochkoff has also invented a "condenser," by which the generated electricity can produce double its illuminating effects along with improved quality of light.

By pressing a button, the electric candles can be instantly extinguished or lighted; the light, if too strong, can be modified by adding a chemical—strontia, for example—to the cement, or employing dimmed glass lamps or globes. The light which passes through glass thus dulled resembles that from the moon when at its full, only more intense, since the artificial star is nearer to us. The electric is the only light which can be compared with that of the sun, and, consequently, with that of the moon, which is but the reflection of the sun's; it is complete in the sense that it unites the very numerous and very different rays, whose combination produces upon us the impression of white light. The light from ordinary lamps and gas is incomplete; the red, orange and yellow rays abound; there are only a few of green, fewer still of blue and none at all of violet. Hence, why the eye cannot recognize by these lights the true colors of a stuff; the contrary is the case with the electric candle. The electric contains more blue and violet rays than solar light, and this is owing to the volatilization of the carbon and the Voltaic arc, and explains at the same time its wanness, or sickly hue. But these blue and violet rays can be filtrated and transformed into white rays. The electric light radiates no heat nor vitiates the air; hence, purer atmospheres in theaters, etc. It is cheaper than gas by one-third to one-half, and most economical when employed on a large scale—and it is only in this sense that it can be placed in competition with ordinary gas; in every other condition it is simply a luxury.

Dr. Colin again draws attention to the undiminished mortality from typhus fever in the barracks situated in Paris and the large cities. This disease alone carries off yearly three soldiers per thousand, or one thousand two hundred in the standing army of 400,000 men. And this rate continues despite all the severe regulations for securing the comfort and well being of the troops—in the long run, a heavier death-rate than from the cholera. Ordinarily, typhus is most to be dreaded most between eighteen and twenty-four years of age. In the French army the deceases from this malady are most numerous at twenty-two years, and three-fourths of the whole are at the expense of conscripts drawn from rural districts and thinly populated villages. Dr. Colin attributes the cause to the crowding together of so many individuals as fatal to life, as monster hospitals are to the sick.

French surgeons continue to report favorably on the combined employment of morphine and chloroform; sensibility is not only thus blunted while the patient is undergoing an operation, but he retains also possession of his senses and his intelligence, so far as to be able to answer questions addressed to him. The German doctors apply the name *morphiomania*, to a diseased use of morphia; it is a malady peculiar to the educated and the rich, but above all, to those whose occupations necessitate great mental exertions. Injections of morphine under the skin is the favorite plan for immediately relieving intense pain and sleeplessness; for a while it becomes a daily necessity, and ultimately a fatal habit. By means of the Pravaz syringe any person can effect the tiny puncture in the skin, and

inject thus the morphine. The use soon becomes an abuse, for the opiate transforms character; the afflicted become gay; the debilitated re-find their strength; the silent become loquacious, and the timid bold. But once the morphine is eliminated from the economy, profound depression ensues. Relief can be only obtained by stronger doses, and the vicious circle around the unfortunate narrows day by day. The evils are precisely those that follow from alcoholic poisonings. Many recur to the injections to benumb griefs, others to enjoy an agreeable excitement. Strange, indulgence in the passion produces exactly the sufferings, that when first taken the drug was intended to alleviate. The afflicted, when they do not terminate their lives by suicide, perish from *delirium tremens.* Dr. Levinstein, who has treated several cases can suggest no cure; as a preventive, never allow other than a doctor to effect the injection from the first.

Up to the present, nothing satisfactory was known of the manner in which the caseum of milk was transformed into cheese. In other words, chemistry supplied no theory; the observations of Payen remained exact, that the fatty matter of the milk played no part in the change, as its percentage was found to be the same in the cheese. The French Government has deputed M. Duclaux to study the question, and that chemistry finds, that while the fatty matter undergoes no alteration as to proportion, it experiences a kind of saponification and a slight change in taste. In respect to the caseum, it is gradually converted into two albumens; one, soluble in hot water and the other coagulable therein like the white of an egg. In dissolving and replacing the caseum, the albumens impart to the cheese a semi-transparent and soft character, and the quality of melting in the mouth. The changes demand time to be brought about, hence, why cheese requires months to ripen.

M. Corenuinder, of Lille, continues his researches on the chemical composition and the functions of leaves. He has already shown, that during their young age, leaves exhale day and night, carbonic acid; but that this exhalation diminishes as the leaves increase, ceasing completely when mature. A corresponding diminution occurs with respect to the saline and nitrogenous matters. In the case of permanent leaves, the new leaves give off carbonic acid during the day, while the ancient leaves do not possess this property. It is concluded from the predominance of nitrogenous substances in the new leaf, that such serve the functions of respiration, while the rôle of the green matter is limited to the office of assimilation.

Since a dozen of years, in many railway termini, hotels, factories and cities, electric clocks have been employed. These were merely dials, on which the hours and minutes were repeated by means of electric conductors communicating with the type or mother clock. This plan had many drawbacks, owing to the perturbations caused by atmospheric influences. The problem then still remained to be solved, how to distribute in different parts of a city or a building, the exact

hour; how to put in movement a determined number of clocks by means of an apparatus, at once normal and unique. M. Mayerhofer, of Vienna, a machine manufacturer, has met the difficulty. By means of his pneumatique clock, he is able, with compressed air, to lay on the exact hour, as water and gas are distributed by subterranean pipes, and since a year the street clocks of Vienna are thus worked. The hands on the clocks correspond with the meridian of Vienna, of course, and are connected with the central clock by means of tubing and compressed air, which put in motion the minute and the hour wheels. The impulsion comes from the central clock, itself in relation with the observatory. A piston works in a cylinder filled with mercury and pushed by compressed air; a rectilineal movement ensues, corresponding to minutes and hours which is transmitted by the tubing to the several dials. In the central establishment are two reservoirs of compressed air; the first has a pressure of from two to four atmospheres, and the second has one-half atmosphere only. In order that the latter may not vary, the air is freed from its watery vapor by being passed over lime; it is also regulated that it will never exceed the pressure of one-half of an atmosphere. It is, from this second or motive reservoir, that air passes into the tubes; the orifice, or escapement, closes at a fixed number of seconds, and the air rushing along the tubes puts all the clock hands in motion, as it is being sucked back into reservoir number one. There is a tell-tale electric wire, like the service-telegraph in a hotel, that indicates if any clocks be out of order. The invention is accuracy itself and will be seen at work pending the exhibition. It is also so cheap that the fronts of houses are being decorated with fancy clock dials.

Glass type is making way, since Messrs. Montcarmont and Dumas prepare it extensively, following the process of toughening the glass, as discovered by M. de la Bastie. The letters in glass look as sharp and clear as those obtained from the ordinary alloy of lead and antimony; can be cast in the same mold and turn out as well into the bargain. It cannot be "battered," and a blow from a hammer will not injure it. Neither is any change experienced when the forms are heated and then wetted to be suddenly cooled for stereotyping. A pound of glass will yield five times more type than a pound of lead, and in addition, never wears. In chromo-printing, those colors having a base of copper, cannot be employed with ordinary lead type; the latter would decompose the color. No such result ensues with glass type. Also it is cleaner.

F. C.

METEOROLOGY,

REMARKABLE STORM AT NEW ORLEANS.

THEO. V. VAN HEUSEN, SIGNAL CORPS, U. S. A.

On the 16th instant there prevailed at this city and immediate vicinity a severe thunder storm, characterized by some very remarkable features, a brief description of which may be acceptable to those of your readers who take an interest in the meteorological department of your magazine.

During the day in question the atmospheric conditions were such as almost invariably precede thunder storms. The temperature rose to 85°, the humidity was above normal (there being present in the atmosphere during the day from 6.25 to 8.35 grains of vapor to each cubic foot of air), and gentle winds, blowing from the marshes to the southward, prevailed.

At 5 P. M. there was observed in the western sky a cumulo-stratus cloud, whose apex had an altitude of about 30° and the base of which extended along the horizon some 45°. While this base appeared to remain stationary, the convex upper portion of the cloud, which was of a deep brown color with white and curling edges, gradually extended itself until it had overspread two-thirds of the sky. The wind at this time had moderated to a light breeze blowing variably from south to east, and the air was oppressively warm and moist. At 5:30 P. M., before any discharge of electricity had taken place, huge scattering drops of rain commenced falling, striking the pavement with a snapping noise like the cracking of a whip, and spattering to the size of a saucer. A moment later there occurred a vivid flash of zig-zag lightning, instantly followed by a crashing peal of thunder and rain descending in torrents. This continued until 5:55 P. M., when a shower of hail commenced falling, which, for size and quantity of the hailstones, is said to have exceeded any phenomenon of the kind heretofore experienced in this section of the country. During a period of five minutes or more the ground was white with hailstones, which, upon measurement, were found to be from one to five inches in circumference. At 6:20 P. M., or after a continuance for the remarkably long period of twenty-five minutes, the hail ceased and rain, descending in sheets, followed until 7:50 P. M. From 6:40 P. M. to 6:45 P. M., there was a second shower of small hail mingled with the rain.

The electrical display during the storm was of unusual magnificence. The lightning flashes were intensely brilliant, being almost exclusively of the zig-zag order—showing the conducting power of the different portions of the atmosphere to be very unequal—and followed each other in rapid succession, while the peals of thunder were long, loud and incessant.

The rainfall was very heavy, 2.82 inches being collected during the two hours and twenty minutes that the storm prevailed. Throughout the lower part of the city the streets were transformed into canals, the water in many sections being waist deep and flooding the lower stories of dwellings. All street travel was necessarily suspended.

The largest hailstones appear to have fallen in the western portion of the city, that being the section first traversed by the storm. Gentlemen whose statements cannot be accepted as otherwise than perfectly reliable, affirm that in that quarter of the city the hailstones were as large hens' eggs in their greatest circumference. Assertions are made that hailstones of this size were picked up after fragments of them had been broken off by violent contact with the pavement. A prominent gentleman who picked up and measured two large hailstones, gives their dimensions as follows: One, 2½ inches long, 2¼ inches wide, and 1½ inches thick; the other, 2½ inches long, 2½ inches wide, and 1¼ inches thick.

The damage occasioned throughout the city was considerable. Sky-lights and window-glass were broken, conservatories, nurseries and hot-houses suffering severely in this respect, with the addition of the total destruction of many valuable plants. Many of the slates which form the roof covering of the majority of houses in this city were cracked and splintered, while some of the extra heavy plate-glass (½ inch in thickness) in the sky-lights of the U. S. Custom House were cracked. Trees were denuded of their foliage, shrubbery beaten to the ground, and one instance of serious bodily injury is recorded from the falling hailstones.

During the prevalence of the storm a game bird, of a species known as "blue rail," and which is rarely seen in this section, though sometimes encountered in the marshes 100 miles south of the city, fell to the pavement dead. Upon examination its back and wings were found to be covered with ice, showing it to have passed through a current of air whose temperature must have been considerably below 32°.

The fall of temperature during the progress of the hail storm is somewhat remarkable. At 6 P. M. the thermometer read 80°. At 6:25 P. M. it stood at 65°, a fall of 15° in twenty-five minutes.

But little wind accompanied the storm, the highest recorded velocity being twelve miles per hour. Violent gusts at street corners and exposed places, sufficient to destroy umbrellas, tear down signs, awnings, etc., were reported. The wind, which previous to the storm had been blowing gently from the southeast, after its passage blew briskly from the north.

Advices from various portions of this State show similar, though much less violent and remarkable disturbances to have taken place.

NEW ORLEANS, LA., April 21, 1879.

STATISTICS OF METEOROLOGY IN THE CITY OF OAKLAND, CALIFORNIA, FOR THE YEAR 1878.

Observations taken at seven o'clock A. M., two o'clock P. M. and nine o'clock P. M. of each day, by J. B. Trembley M. D. Latitude, 37 deg. 48 min. 20 sec. north; Longitude, 122 deg. 15 min. 20 sec. west. Height above the sea twenty-four feet.

TEMPERATURE.

Table showing the mean temperatures of the months, warmest and coldest days; also, the maximum and minimum temperatures, the greatest and least daily variation, monthly and mean daily range of 1878.

1878	Mean Temperature of the Months.	Mean Temperature of Warmest Days.	Mean Temperature of Coldest Days.	Maximum Temperature.	Minimum Temperature.	Greatest Daily Variation.	Least Daily Variation.	Monthly Range of Temperature.	Mean Daily Range of Temperature.
January	50.03	57.66	36.66	66	28	20	3	38	10.66
February	50.81	56.66	45.00	61	38	19	2	23	10.14
March	54 02	60.33	47.00	69	39	20	4	30	11.03
April	55.30	62.00	45.33	73	40	21	6	33	12.63
May	57.88	65.00	55.00	81	47	24	7	34	13.67
June	59.34	64.33	56.33	79	52	24	9	27	13.06
July	59.20	64 33	56.33	79	52	24	9	27	13.06
August	59.55	65.00	57.00	77	53	22	6	24	12.25
September	59.32	64 66	56.00	79	48	23	5	33	13.93
October	58.05	69.33	51.66	84	42	33	7	42	19.70
November	53.39	58.00	47.00	69	36	27	3	33	15.13
December	46.49	58.00	37.00	73	27	33	4	46	18.61
Means	55.28	62.13	49.19	74	41	24	5	32.5	13.65

RECAPITULATION OF TEMPERATURE.

Mean temperature of the year	55.28
Mean temperature of warmest day, October 21st	69.33
Mean temperature of coldest day, December 29th	37.
Maximum temperature for the year, October 21st, two o'clock P. M	84.
Minimum temperature for the year, December 29th, seven o'clock A. M	27.
Greatest daily variation, December 3d	33.
Least daily variation, February 17th	2.
Greatest monthly range, December	46.
Least monthly range, February	23.
Average daily range for the year	13.65
Average monthly range for the year	32.5
Yearly range of temperature	57.

SEASONS.

Mean temperature of Spring	55.73
Mean temperature of Summer	59.36
Mean temperature of Autumn	56.92
Mean temperature of Winter	50.12
Difference between coldest and warmest months of Spring	3.86
Difference between coldest and warmest months of Summer	.35
Difference between coldest and warmest months of Autumn	5.93
Difference between coldest and warmest months of Winter	1.28
Difference between coldest and warmest months of the year	13.06

METEOROLOGICAL SUMMARY FOR MARCH, 1879.

SIGNAL OFFICE, LEAVENWORTH KANSAS, APRIL, 1, 1879.

The most notable features of the meteoric conditions, during March, were the generally high pressure; high temperature; low humidity; light rainfall and no storms.

The mean barometer of the month was 30.053 inches, about .06 above the March mean. During the first three days of the month the pressure was notably high. The mean of last month was higher than that of any year since 1872. The highest barometer during the month was 30.603 on the 2d. The lowest, 29.573, on the 8th.

The mean temperature of the month was 45.42°, about 6° above the March average, and with the exception of 1872 (50.90°), the highest March mean ever observed at this station. The highest temperature during the month was 84°, on the 27th, which was the highest temperature ever observed at this station in March. It was ten degrees above the mean of March maximum temperatures. The highest March temperature previously observed, was 80°, in 1878. The lowest temperature was 9° on the 14th. Greatest daily range 40°, on the 23d and 27th. Least daily range 8°, on the 16th.

The mean percentage of humidity during the month was 55.52, being 11.54% below the March mean. The lowest observed during the month was 11% at 2 o'clock p. m., on the 23d. The mean of last month was less than any March since the station was established, in 1871.

The total rainfall during the month was 0.32 inches, which was 2.79 inches below the March mean. The lowest March rainfall previously observed at this station was 1.75 inches in 1873. The greater portion of the precipitation last month fell during the first five days of the month.

The prevailing wind of the month was north. Highest velocity thirty-six miles, from the N. W. at 3:40 p. m., 23d. Total number of miles registered during the month, 6997. The wind's direction was recorded 217 times as follows: N., 56 times; N. W., 42 times; W., 2 times; S. W., 10 times; S., 47 times; S. E., 16 times; E., 14 times; N. E., 18 times and calm 12 times.

Number of clear days during the month 9; fair days 14; cloudy days 8 and number of days on which rain or snow fell, 6. A solar halo was observed on the 23d; a lunar halo on the 31st and polar bands on the 17.

The following table showing mean barometer, thermometer and humidity, total rainfall, maximum and minimum temperatures and highest and lowest barometer, during March, of the past seven years, is furnished as an item for comparison:

YEAR.	Mean Barometer.	Mean Thermometer	Mean Humidity.	Total Rainfall.	Maximum Temperature.	Minimum Temperature.	Highest Barometer.	Lowest Barometer.
. . . .	. . .	deg's.	per c't.	inches.	deg's.	deg's.	. . .	. . .
1872	30.093	37 08	67.35	1.95	70	16	30.760	29.250
1873	30.015	42.10	. . .	1.75	73	5	30.670	29.470
1874	30.010	40.00	70.40	3.05	69	18	30.656	29.290
1875	29.967	37.60	60.20	2.50	78	9	30.427	29.354
1876	29.986	35.16	72.60	5.78	68	2	30.605	29.421
1877	30.003	38.40	69.80	4.39	78	7	30.453	29.388
1878	29.856	50.90	62.00	2.35	80	28	30.257	29.339
1879	30.053	46.42	55.52	0.32	84	9	30.603	29.573
Average of Years.	29.990	40.18	67.06	3.11	73.7	12.1	30.547	29.359

SAMUEL W. RHODE,
Signal Corps, U. S. A.

MINING AND OTHER INDUSTRIES.

DESCRIPTION OF VARIOUS MINES IN COLORADO.

BY JOHN K. HALLOWELL.

As Messrs. Hayden and Raymond, in their reports have not given us a nomenclature of the rocks and minerals of this locality, I have thought best to merely use the names for the different rocks as known locally, although satisfied that scientifically they are not, as a general thing correct.

From the divide near the head of Hardscrabble Canon and following a south of west course, is quite a valley with a general gentle inclination down to the foot-hills bordering the Wet Mountain Valley. On the south side of this and among these foot hills, Round Mountain and Silver Cliff are situated, and about six miles west of the Franklin and Maine Mines, the elevations on the south side with their foot-hills are Porphyry; those elevations to the north, Granite; the deepest denudation of the valley following the line of contact, with spurs of Trachyte appearing between the granite hills to the northward.

The Porphyry formation is easily distinguished by the largest axis of the hills following the general course of the valley, viz: East and west. Their rounded tops on the south side bare of trees, covered instead with grass and verdure, no massive out-crops of rock like the granite hills, and having the steepest slope on

the south side, the gradual slope on the north, and generally on this side heavily timbered to their summits with aspen, pine and spruce, the aspens taking up their location among the gulches and foot-hills where, of course, the most moisture and vegetable mold accumulate.

The highest one of these porphyry peaks is Mount Tyndall, and on its north foot-hill is situated the justly celebrated *Maine (or Bassick) Mine.* Not having obtained the desired data regarding this wonderful mine, (but which I hope to have with reports of others for your June issue) I merely mention it at present to record the following extract, in connection with an illustrative fact:

"The intervention of intense heat, sublimation, and similar hypotheses to explain the origin of metallic ores, we conceive to be uncalled for. The solvent powers of the solutions of alkaline carbonates, chlorides and sulphurets at elevated temperatures, taken in connection with the notions above enunciated, and with De Senarmont's and Daubrée's beautiful experiments on the crystallization of certain mineral species in the moist way, will suffice to form the basis of a satisfactory theory of metallic deposits.—*Chemical and Geological Essays, by T. Sterry Hunt, page 221.*

At a depth of 160 feet in the Maine Mine, and attached to the small boulders or pebbles that this ore deposit contains, have been found pieces of *charcoal.* Mr. Hunt could not have a better illustration of his theory if he had fixed up this ore deposit himself.

Next, in present importance and value, of the numerous mines in this section, is the "*Benjamin Franklin Mine,*" which was purchased by the present owners in the fall of 1877. At the time only a discovery shaft had been sunk but which gave good indications of a permanent deposit of mineral—in fact, a pocket in the quartz had been opened, consisting, mainly, of carbonates and a few tons of mineral obtained, which gave good mill returns. On the present management obtaining control, a new exploration shaft was started and sunk to a depth of seventy feet. At this point drifts were run in different directions, one of forty feet north; one of forty feet south; one of twelve feet west and another of seven feet east and no mineral found. But being satisfied that it was there and in paying amounts, work on the surface was commenced again near and just above the original discovery shaft. Here, at a depth of about ten feet a small pocket of of carbonates was found, and from that point mineral has continued in pockets of quarter or less amounts to a depth of 200 feet. The pockets produced each from a few hundred pounds to sixteen tons. From the seventy foot exploration shaft one of the drifts was continued westward to this, what is now the main shaft. The old discovery shaft was sunk down to it also, and is now used as a manway, the drift or tunnel being used for ventilation, so that what at first appeared as a loss in the working, has, by good management and judgment been made of great advantage and practical utility in the working of the main shaft, which the tunnel opens into at a depth of 105 feet. The strike of the lode is in an east and west course, the dip south one foot in three. The quartz is used as a foot-wall,

and partially removed as the shaft is sunk, the hanging wall being Porphyry, and compared to the quartz is very easily worked. Down to water level the mineral was principally carbonates, with occasionally a mass of galena of fifty or sixty pounds. At about ninety feet water was reached, and the mineral was found in the pockets in a crystallized form. It is principally Argentiferous galena, with zinc blende, iron and copper pyrites; some gray copper and also antimonial silver. The first indication of approach to a deposit of mineral, is the shattered condition of the quartz and an increased flow of water. On top of the pocket, when first opened, is found metallic geodes, weighing from a few ounces to several pounds. On breaking one open the center will be of pyrites, surrounded with a ring of zinc blende or galena, also spots of gray copper intermingled and a thin band of antimonial silver surrounding the whole between the galena and zinc. Passing below the layer of geodes the mineral is found finely crystallized and easily worked, the bottom of the pocket producing the largest mill returns generally. Usually a thin streak of mineral leads from one pocket to another. At a depth of about 170 feet, a five ton pocket was emptied, and a horizontal streak of mineral was seen on the north side, which, on being followed up led to a larger pocket on about the same level. This would indicate a probability of a very much larger amount of mineral being still in the quartz above than has been taken out. From the latter deposit some very fine geodes were obtained with a center of *quartz*, both massive and crystallized, and surrounded with the other metals same as those containing a center of pyrites, and out of this a picked specimen of brittle (antimonial) silver gave an assay of 1876½ ounces per ton, although the mill result was not as high by a few ounces per ton as the previous pocket. On breaking through the north wall of this chamber a soft gangue was found, and beyond that the Porphyry, showing that the quartz had been entirely penetrated at this point and giving thickness of about fourteen feet.

The motive power being mules, a whim and two buckets, it was determined to run levels at a depth of 200 feet, and accordingly that work is being done. Simultaneously, levels in an east and west direction were started. The east one has been run but twenty-five feet and, appearing barren, has been temporarily stopped. At seven feet from the shaft on the west drift a large pocket was cut through and mineral left both above and below; that above being stoped out by one man, and the level continued by the rest of the force west, for a distance of forty-five feet. Here the quartz was found much shattered, and containing considerable heavy spar, which is a most excellent indication. But it was found that the quartz here narrowed down to about four feet, and a return level is now being run on the north side of the lode, which will probably develop more mineral on that wall, and when continued so as to open into some of the last pockets emptied in the shaft, will form a most excellent air-conductor and ventilator for new work still farther west.

Among the minerals, I have seen some fine crystals of Franklinite attached to the quartz, and in the decomposed rock near the pockets I have obtained per-

fect crystals of that mineral, free and also fine crystals of pyrites, and, what is quite uncommon in this camp, these pyrites will give good assays in silver.

On the surface, about 300 feet south and parallel with the quartz outcrop of the Franklin, is a large dyke of syenite toward which this quartz lode dips, and towards the bottom of the shaft, jutting through the Porphyry, (properly speaking *Trachyte*) blocks of this syenite have been met, indicating that somewhere, not a great distance farther downward, there is a place of contact between the two dykes of syenite and quartz. At this place of contact will probably be found a regular vein of richer mineral pitching downwards in addition to what the quartz may contain in pockets.

The present condition and past results obtained in this mine reflect great credit on the working management, and give all who are acquainted with it confidence that the future workings will not only give much pay mineral produced by careful and economical supervision, but also prove a source of large profit to all of the owners. Two shifts of men are employed, twelve in all, with two boys to operate the mules, constant work being kept up, except from mid-night of Saturday until Monday morning, and during this idle time only forty to fifty barrels of water accumulate in the shaft.

While the products were carbonates or free milling ore, it was treated at the Pennsylvania Company's Reduction Works, at Rosita. Afterward, becoming too refractory for their process it was shipped by wagons to Messrs. Mather & Geist, Pueblo, Colorado. The road from here to Pueblo is down hill most all of the distance, (fifty miles) through Hardscrabble Canon. Freight is $8.00 to $10.00 per ton, according to season and condition of roads. During the last two months over twenty tons of mineral have been shipped, (leaving about three tons on hand at this date) and giving mill returns of 121 ounces to 174 ounces in silver, or an average of about 142 ounces. No expense is incurred for sorting this ore, as when a pocket is opened it all comes in a body, and is merely dried by the ore-house stove and sacked ready for shipment, each sack averaging about 140 pounds. As an instance of how free this mineral is to mine, in the pocket mentioned as being on the north wall, the second day after it was opened, one man in one shift of eight and one-half hours took out over two tons of pay mineral.

I have endeavored to be thus minute in the description of this mine, as well as exact, from the fact that it is for this camp a remarkable ore-body, and also that it is a successful development where many others would have failed in producing pay. I am under obligation to Mr. Thurman, General Manager, and Mr. Williams, Foreman, for the facts and facilities for observation, the results of which I have given.

SAN JUAN MINING ITEMS.

The Diamond Tunnel.—The editor of the *Miner* visited this tunnel yesterday, and we can report most favorable progress since our last visit one week ago. A very rich streak of mineral was struck the day following our visit last week, and this streak has continued to improve and is undoubtedly a permanent pay streak. The ore is as fine looking as any we have seen in the country. Assays of the streak made during the week by E. T. Sweet gave 395 ounces in silver to the ton. The drift west from the tunnel has been pushed fourteen feet during the past week through a good ore body the entire distance. A stope will soon be started. The main tunnel is progressing finely and a drift will be started on the vein just passed by the face of the main tunnel. This vein we regard as one of the most promising on the mountain. It is over five feet in width and has a large body of ore. It appears far superior to the vein upon which the drifting is now being done, looked at from the point where the tunnel intersected it. We are most thoroughly convinced that there is no more valuable tunnel property in San Juan than the Diamond tunnel of the Silver Producing Mining Company. All parties familiar with the mountain believe that good paying veins will be tapped by the tunnel every 100 feet for the next 1,000 feet. Work will be pushed upon this enterprise with all the force that can be worked to advantage, and we are satisfied that its ore product for the summer will be a most agreeable surprise to its owners, for in less than six weeks it will be sending out ore from at least four good paying lodes, any one of which will be opened to a depth of 250 feet.

Mount Sneffels.—Mr. John Wilson and R. B. Brown came over from Mt. Sneffels yesterday. Mr. Wilson has been at work on the Yankee Boy since last fall. They have been running a cross-cut tunnel during the winter. They have run over 200 feet and have tapped the vein at a depth of 100 feet. The vein, where it has been tapped, looks well.

The Eldorado, owned by Shultz & Rinkor, has also been worked during the winter. The owners have run a tunnel on the vein, which is looking splendidly.

The Virginius has been worked all winter by fourteen men. They have about 100 tons of first-class ore out.

The Blackbird, on Bear Creek, is turning out splendidly.

The Crusader, owned by Weston & Co., has just been started up. This mine shows a good vein of mineral.

The company that owns the Wheel of Fortune, will commence work in a week or ten days. This mine will be worked extensively this summer.

The company which purchased the Quinn and Gichardson mines will also commence work early in the season.

Mr. Wilson says the trail is in first rate condition. They made the trip from Sneffels yesterday without use of snow shoes.

Howard Fork.—A very rich gold lode, in a most peculiar formation, has been discovered on Marshall Creek, one of the tributaries of the San Miguel.

The lode is called the N. W. H. Jr., and is owned by Andrews & Savage. There is a crevice eight feet wide, with twenty-seven inches of Galena ore. There is a tunnel on the vein fifty feet in length. In running this tunnel the owners have crossed a streak of gold, imbedded in the galena. The streak was half an inch in thickness, and Mr Scott, who gives us the item, says that the owners have taken out a cigar box full of almost pure gold. This mine is located about six miles from Ophir.

THE SMUGGLER LODE.—This lode is also located on Marshall Creek, and is owned by Osburn & Ingraham. This mine has a four foot crevice and a pay streak of twelve inches of galena and gray copper. They have $12,000 worth of ore on the dump.

There have been three pack train loads of ore shipped from the Nevada lode to Ouray this spring.

THE EUREKA MINING CO.—The Eureka Mining Company of Wyandotte, Kansas, owns three good mines near Eureka, in this county. The property is very desirably located for working, being only half a mile from the Reduction Works of Winspear & Co., at Eureka. The property was located by Mr. Peters some four years ago, and is among the best in that rich camp. The names of the lodes are the Daisy, Little Maud and Paymaster. The Daisy carries some very rich mineral, assays made by Cady & Olmstead, of Kansas City, giving 884 ounces of silver to the ton of ore. The company also owns a valuable mill site and water power, only one-fourth of a mile from Eureka. Dr. W. C. Hamilton, of Topeka, Kansas, is secretary of the company, and Fred C. White and N. McAlpine, of Kansas City, are large stockholders, and we understand the company will commence work in a few weeks upon their property and will push its development this summer. They have splendid property, and we are satisfied they will meet with success.—*La Plata Miner*.

THE ALASKA CONSOLIDATED.—Within the last sixty days a most important mining transaction, to the San Juan country, has been closed. At the head of Poughkeepsie gulch, which is partly in the San Juan and partly in Ouray county, are a number of mines which have attracted marked attention from the richness of the ore produced and the ease of working. The discoverers were not able to expend the capital necessary to develop them, and last season some eastern parties, principally residents of Cleveland, Ohio, secured a bond on the property, organized the Alaska Consolidated Mining company, and quietly awaited developments. Previously however, four practical miners, Messrs. Bennie, Renfro, McElroy and McCormick, secured a lease on a royalty from November, 1878, to June, 1879. They went to work in November, with a slender capital, but in eight days had taken out enough ore to buy a stock of tools, provisions, powder and steel to last them through the winter. At the last report their ore on the dump, three-quarters of product, was worth $15,000, and will probably, by June 1st, net them $20,000. This was done on the Adelphia alone; the other lodes

are the Alaska, Acapulco and Victory, and all were included in the property acquired by the company, which was organized on a basis of a capital stock of $2,000,000, in shares of $25 each. Attracted by the reports of the richness of the San Juan veins, Messrs. Tabor and Rische investigated the country, and purchased in the Red Roger and Saxon. Afterward they tried to buy out the mines above named, but could only get a one-half interest, which they now hold.

The new company will work their mines, using all the force that can be operated advantageously and for the present will sell their ore. Their property is most advantageously located in respect to reduction works, it being four miles to the San Juan reducing works at Gladstone: three miles to Animas Forks concentrating works; ten miles to Ouray, where there are three smelters; eleven to Silverton and twenty-two to Lake City. In the Adelphia is a vein of gray copper, with spar and pyrites, of five feet of mineral which averages five hundred ounces, it runs all the way from ninety ounces to eleven hundred. The property is a veritable bonanza and is held for profit and not for sale. The purchase is a significant fact, showing that the true fissure veins of the San Juan country are regarded as good investments, even by men who made their fortunes in carbonate fields. It proves that all the capital and all the enterprise will not locate in one place or in one spot, but that the wonderful resources of Southwestern Colorado are beginning to receive due recognitition and suitable acknowledgement.

—*Denver Democrat.*

THE COMMERCIAL APPLICATIONS OF REFRIGERATION.

The comparatively new business of exporting live cattle from this country to Great Britain has had very remarkable vicissitudes—at times returning good profits, and at others entailing heavy losses. Several hundred head per week are being shipped from our port, but it may be rather premature to judge what will be the final result in this department of the business if the existing restrictions are long maintained. It looks, however, as if there might be a renewal on a much larger scale of the former only partially successful effort of shipping dressed beef. This branch of the business has of late excited a great deal of attention so far as Boston is concerned, and quite extensive preparations are under way for its development. One of our Liverpool lines has already several steamers fitted with refrigerator accommodations on a liberal scale, and similar arrangements are being introduced into another line. In fact, one steamer was delayed here a day the present week, so as to be supplied with a refrigerator room. One of the very largest cattle dealers of this country is in town, partly to make arrangements as to sending dressed beef of his own to Liverpool, and he has forwarded several heavy shipments lately from this port. Last year, a number of the shipments of beef arrived on the other side in poor and unprofitable order, owing to long voyages or inadequate refrigerator arrangements, or both. The refrigerators already in-

troduced and in use upon some of our Liverpool steamers represent several different makes, the object in this seeming to be to test the comparative merits of each. There is a very sharp competition between the representatives here of the some half a dozen leading makes of refrigerators used in transportation, each naturally claiming that his own is, upon the whole, the best system, and seeking for it some advantage.

The ocean voyage, even from this port, is so much longer than the inland journey, and so much more risk is involved on shipboard as to delays and other causes, that extra caution is required of shippers, and the best possible refrigerator arrangements demanded. Up to this time, ice has been the only agent used on cars and steamers to secure a preservative temperature. Chemical methods, however, have been under private experiment by different parties the world over. There are also at least two different parties in this city now engaged in experimenting on a large scale with systems of producing cold, without ice and without chemicals, by—as it were—pumping the caloric out of the refrigorating chamber. The parties referred to as engaged in these experiments have made substantial progress in the use of their machinery, but the matter has not yet sufficently matured for public exhibition. The purpose in the new system is to run the machinery by power to be obtained from the steamship's boilers.

Until the new plan is open for thorough public examination as to its workings, it would be premature to announce anything more than that those engaged in the matter are sanguine, from what they have already accomplished, that they will secure a practical success. Should the anticipations of those working on the new system be realized, quite a revolution would take place in the method of refrigerator transfer, both on rail and ocean, as well as in cold warehouse storage on a large scale.—*Boston Journal of Commerce.*

NEW INSTRUMENT TO DETERMINE THE PRESENCE OF METALS IN ORES.

At a recent meeting of the Philadelphia Academy of Natural Sciences, Prof. George A. Koenig, of the University of Pennsylvania, exhibited his recently invented "chromometer," an instrument designed for the purpose of making exquisitely delicate determinations of the presence of certain metals in ores. It is based upon the optical fact that complementary colors will extinguish each other if mingled in proper proportions; for instance, if to a green solution a red solution be added, the liquid, if the proper conditions be complied with, will become colorless. The speaker had applied this principle to the colors which certain metals, as iron, manganese, copper, etc., produce when fused with borax, which is the only chemical used in this method of analysis. He prepares such glasses or beads containing known quantities of a metal in one hundred parts, and observes how thick a glass of the complementary color must be to produce

extinction. To accomplish this, the instrument is furnished with a glass wedge of a green or red color, cut at an angle of about one degree. By moving this wedge before the glass bead, with the help of a suitable rack movement, a scale moves at the same time, and, when the point of extinction of color is arrived at, the reading of the scale refers to a table showing the percentage of metal contained in the examined substance. By this method of analysis a correct determination of manganese in an iron ore can be made in fifteen minutes, which is not more than one-third the time required by the usual methods of analysis.—*Scientific American.*

HOW TO GET TO SAN JUAN.

Parties who desire to get to Animas Forks, Mineral City, and all important points in the San Juan country, can now do so without difficulty, by coming by way of Cunningham Gulch. The wagon road is now open to the foot of Grassy Hill, on the other side of the range, and from Highland Mary, on this side. Pack-trains have already been sent through to Animas Forks, from Silverton, loaded with supplies.

The development of the mines of San Juan has fully demonstrated the fact that Silverton is the gateway to the treasury vaults of the San Juan country. It is the most beautiful location for a town in all southern Colorado, added to the fact that in every direction from it are mines which have been found rich and paying properties. The development of the country is far in advance of the city, and those who invest their money in business enterprises in the city have the assurance that the mineral wealth of the immediate vicinity is a guarantee of profit in any business undertaking. It is only twenty miles from Silverton to the head of the Dolores, and animals have already gone over, via Howard Fork. The Needle Mountain district is south of us, only twenty miles. Howard Fork, Turkey and Bear creeks west, twelve to fifteen miles; head of Cement and Poughkeepsie Basin, nine to ten miles; Kendall mountain, half a mile; Hazleton mountain, two miles; Arastra Gulch, two and a half miles, Sultan mountain, one mile; Cunningham Gulch and Howardsville, four and a half miles; Eureka, eight miles; Burns' Gulch, ten miles; Picayune Gulch, ten and a half miles; Animas Forks, twelve miles; Mineral City, fourteen miles; Mount Sneffels, eighteen miles. So it will be seen that Silverton is the center. The above named points, all noted for their rich mines, are in every direction from our town, and all, excepting only Mt. Sneffels, must become tributary to Silverton, as the great business center of San Juan in the future.—*La Plata Miner.*

SCIENTIFIC MISCELLANY.

TESTS OF SILKS.

A lady who has visited the most important silk factories in Europe has given the result of her observations in this connection. She says it is next to impossible to detect the genuine article, and that she knows of but four reliable firms who tell the truth about their products. She gives the following suggestions: "If the sum at disposal be moderate, a very good silk is forthcoming, though it may not be a cord; if a useless dress is wanted, the silk ordered, for instance, is a robe *de fatigue*, or it is a *drap d' Anvers*, or a *drap de Rhone*, the word "drap" at Lyons not signifying cloth, but plain, close textures of black silk. Samples should be written for, and when in hand there is a method for selecting a good silk from a bad one. If, after having made a fold on the cross in a sample received, it is not easily effaced by pulling it over again with the first finger, or by pulling the material in a contrary direction, that silk is bad. If, on the other hand, the ridge imperceptibly disappears, the material is good, for silks should be supple, however thick."

Another writer on this subject adds some additional hints of a noteworthy character:

"Formerly, the silk manufacturers used ungummed silk both for warp and weft. The ungumming softens the silk and removes from it a resinous matter; but there is a great loss of weight—in French silks 25 per cent, but in Chinese silks sometimes 40 per cent. The manufacturers have, for some time past, ungummed merely the silk for the warp, leaving that for the weft raw, as the threads of the warp are not seen.

"In this manner a great loss of weight is avoided; but the goods, as soon as wetted, become uneven. This happens especially where such tissues are dyed, when the weft is attracted by the color and the mordant, and becomes rough and broken. Like all other fibers, that of silk consists of a number of small particles linked together. These become prominent on ungumming, so that when a silk fabric consisting entirely of ungummed silk is moistened, no alteration appears. But in common silk goods this only happens with the warp. The moistening, finishing, etc., of these goods occasion a difference between the threads of the warp and weft. This explains the distortion of such goods, and their tendency to break in the folds,"

Concerning the color of black, there are very unreliable green-blacks and dun-blacks. The real blue-black is the highest esteemed. The raven's-wing has a blue haze over it. It is said that no one not in the business can know how difficult it is to get a glossy blue-black in the matter of silk goods; a dead black is

not the accomplishment of this end. Cheap qualities of silk would not reward the manufacturer for his trouble; hence a brown or green-black are of inferior fiber. Experts in the selection of silks adhere to certain rules which guide them in the matter. Among others is that of noting the closeness and evenness of the rib in the fabric, and to facilitate this end they hold it to the light, by which means the character of the texture is discovered. The goods is crushed in the hands also, and if it springs out quickly when suddenly released, what is termed verve is developed. The quality of the silk is denoted by the verve. The softest silk produced is said to be the Italian, possessing little stiffness in its appearance. The Chinese silk is the most inferior and deficient in verve. And there is a kind of silk produced, in the manufacture of which jute is used in the process of adulteration, which is interwoven in the fiber of the silk. This fabric is found very deficient in verve. It is a silk which, if wetted, stiffens similar to paper.

Iron can be protected from rust and made very pleasing in color by a method invented by Mr. Dode. He coats the surface with a thin film of borate of lead, in which some oxide of copper has been dissolved, and some scales of precipitated platinum held in suspension, by means of a brush or a bath. He then heats the composition until it is fused. The result is a thin, glassy coating, which will withstand the action of sewer gases, dilute acids of alkalies, and the heat of a kitchen fire. If all be true that is said of this "platinized iron," as it is called, it will find numerous applications.

MAKING LUMBER FROM STRAW.

Mr. H. S. Hamilton, of Bushnell, Ill., has discovered a process for making hard-wood lumber out of common wheat straw, with all the effects of polish and finish which is obtainable on the hardest of black walnut and mahogany, at as little cost as clear pine lumber can be manufactured for. The process of manufacture, as explained by Mr. Hamilton, is as follows: Ordinary straw board, such as is manufactured at any paper mill, is used for the purpose. As many sheets are taken as are required to make the thickness of lumber desired. These sheets are passed through a chemical solution, which thoroughly softens up the fiber and completely saturates it. The whole is then passed through a succession of rollers, dried and hardened during the passage, as well as polished, and comes out of the other end of the machine hard, dry lumber, ready for use. It is claimed that the chemical properties, hardening in the fiber, entirely prevent water soaking, and render the lumber combustible only in a very hot fire. The hardened finish on the outside also makes it impervious to water. The samples exhibited could hardly be told from hard-wood lumber, and in sawing it the

difference could not be detected. It is susceptible of a very high polish, and samples of imitation of marble, mahogany, etc., were shown which might deceive the most experienced eye. Not only does Mr. Hamilton claim a substitute for lumber in sash, doors and blinds, and finishing stuff, but also as a substitute for black walnut and other woods in the manufacture of all kinds of fine furniture, coffins, etc., and also an excellent substitute for marble in marble-top tables, mantelpieces, bureaus, etc. He claims that it will not warp in the least.—*Leffel's Mechanical News.*

BOOK NOTICES.

PRACTICAL INSTRUCTION IN ANIMAL MAGNETISM. By J. P. F. Deleuze. Translated by Thos. C. Hartshorn. New York: S. R. Wells & Co. Pp 524, 12mo.

M. Deleuze was first known to the scientific world by his translation of Darwin's "Loves of the Plants," which he published in 1799, and which gave him an established reputation among scholars and naturalists. Subsequently he published a comprehensive work named "Edoxus," which was a general summary of existing science, in the form of conversations upon the study of the sciences, letters and philosophy. His devotion to botany and kindred sciences did not prevent his giving attention to other things, and he was distinguished as a naturalist. At the same time he devoted himself to the study of Animal Magnetism, which about the close of the eighteenth century was creating great excitement on the continent. After reflecting on and investigating the subject for a quarter of a century, he published the work now under consideration, which, even at this late day, seems to cover all that is known of either the history of magnetism or the science itself, including, as it does, its general principles, its effects and their application, the accessory means for increasing magnetic action, its application to various diseases, etc., etc. The work of translation seems to have been faithfully and carefully done, and the publishers have done their part handsomely and tastefully.

THE NATURAL RESOURCES OF THE UNITED STATES. By J. Harris Patton. New York, 1879: D. Appleton & Co. For sale by M. H. Dickinson, Kansas City; 50c.

The numerous series of Science primers, History primers, Health primers, Literature primers, now being published by the first publishing firms of the country, and the great sales they are having, are indicative of the tastes of the American people, and at the same time a fitting tribute to the "fast age" in which and of which we are. Every man wants to know all about chemistry, and geology, and literature, and history, but cannot afford to devote more than half an hour to the

acquisition of a knowledge of any one of these subjects; hence the "pocket" editions, "vest-pocket" editions, and, as we expect to see soon, the "watch-fob" editions of the works of all the prominent authors of the world. Of course much of this kind of smattering literature is worthless, and perhaps does more harm than good, but there are some subjects that can be so treated without this danger and the little work in hand is one of this kind. The author points out the resources of the United States, as far as he goes, very concisely and very correctly, and it is well worth the price to any reader, old or young.

HONEST MONEY AND LABOR, by Hon. Carl Schurz; NATIONAL BANKING, by M. L Scudder; HINDRANCES TO PROSPERITY, by Simon Sterne. G. P. Putnam's Sons, New York. M. H. Dickinson, Kansas City; 25c each.

These are Nos. XI, XII, and XIII, of the "Economic Monographs" published by the New York Free Trade Club, and, as the names of the distinguished authors guarantee, are valuable and reliable contributions to the literature of finance and political economy.

We have also received from the same firm Nos. 1 to 5 of the Sanitary Series of Hampton Tracts, consisting of "The Health Laws of Moses, and Who Found Jamie?" by Helen W. Ludlow; "Preventable Diseases, and A Haunted House," by Mrs. M. F. Armstrong, and "The Duty of Teachers," by E. W. Collingwood—all of which are plain, practical treatises, or monographs, upon important subjects which should be more fully understood by parents and instructors. Ten cents expended in each one of these tracts will be well laid out.

TRANSACTIONS OF THE KANSAS ACADEMY OF SCIENCE—1877 and 1878. Geo. W. Martin, Topeka, Kansas.

We are indebted to the Secretary, Mr. E. A. Popenoe, for a copy of the above named work, which is a credit to his skill and taste as a book-maker as well as to his ability and zeal as a writer and original investigator.

The Kansas Academy of Science, though young in years, has, through the untiring efforts of such men as Professors Mudge, Snow, Adams, Williston, Kedzie, and others, placed itself among the foremost societies of the country, and its reports will be more and more in demand as it is enabled by liberal state aid to prosecute its work. Several of the most valuable papers in this report have already appeared in the REVIEW, and others will be published hereafter, either in full or in condensed form.

TWO MONTHS IN EUROPE. By O. R. Burchard, A. M. Syracuse, N. Y.: Davis, Bardeen & Co. 168 pp, 8vo, paper; 50c.

Professor Burchard, having snatched two months from his labors as instructor in the Normal School, Fredonia, N. Y., in the summer of 1873, devotes 168 pages to informing the public, in a very pleasant and easy style, what he saw and how little it cost him. He seems to have made the grand continental tour, in-

cluding Scotland, England, Belgium, Germany, Switzerland, Italy and France, and seen about all that is worth seeing, in eight weeks and for the moderate sum of five hundred dollars. Cook's patent tours are made now for a much smaller sum, but necessarily with less satisfaction, as the whole trip is on the "right through without change of cars" plan, and we think we should prefer Prof. Burchard's manner of doing it, even at a slightly increased expense.

REPORT OF THE OBSERVATIONS OF THE SOLAR ECLIPSE—July 29, 1878. Made at Fort Worth Texas.

The party making these observations consisted of Messrs. Leonard Waldo and R. W. Willson, of Harvard College; Prof. J. K. Rees, of Washington University; W. H. Pulsifer, of St. Louis, and F. E. Seagrave, of Providence, R. I. The special end in view was the observing and recording of such phenomena as might aid in establishing the correct theory regarding the corona which surrounds the sun during a total eclipse. The observations made at Fort Worth are regarded as particularly valuable, and this report comprises the individual records and calculations made by each of the above named gentlemen, and is presented in a handsome quarto volume, published at Cambridge, Mass., illustrated with several photographic illustrations showing different phases of the sun at different periods of the eclipse. We published an abstract of the less technical portion of this report in the August, 1878, number of the REVIEW.

OTHER books and pamphlets received, which will be noticed hereafter: Proceedings of the Academy of Natural Sciences of Philadelphia, Part III, September, October, November and December, 1878; edited by Edward J. Nolan, M. D.—Report of Davenport Academy of Natural Sciences, January 1, 1879.—On the Double Stars discovered by Mr. Alvan G. Clark, by S. W. Burnham, Chicago, April, 1879.—Kansas State Historical Society, First Biennial Report, January 21, 1879, by Judge F. G. Adams, Secretary.—The Twelfth Annual Session of the Missouri Press Association, May, 1878, edited by M. B. Chapman, Secretary.—Speech of Hon. B. J. Franklin, M. C., upon the Indian Question, Oklahoma Territory.—The Silk Worm; a Manual of Instruction for the Production of Silk, by Prof. C. V. Riley.—Remarks on Fossil Shells from the Colorado Desert, by Robt. E. C. Stearns, March, 1879.—Address of Prof. J. K. Edgerton, M. D., at Fort Wayne Medical College, on Education and the Medical Profession in Indiana.—The Cultivation of Chemistry, by F. W. Clark, S. B , University of Cincinnatl, O., an abstract of which excellent address was published in the REVIEW for September, 1878.—Biennial Report of the University of Kansas, 1877-8. —Nineteenth Biennial Report of Board of Managers of Missouri Lunatic Asylum, Fulton, Mo., 1878.—Biennial Report of the State Agricultural College, Manhattan, Kansas, 1877-8.—Catalogue of Oberlin (Ohio) College, 1878-9.—Kansas City in 1879, McEwen & Dillenback.—Leadville and Ten-Mile, H. T. Wright & Co., 1879, 25c.

EDITORIAL NOTES.

In commencing upon the third volume of the Review, we again present our thanks to our exchanges for their many favors and kind words during the past year, and to all of our subscribers and patrons for their aid, but especially to the citizens of this city, who have been its chief support at all times and without which the Review would have succumbed long since.

We are aware that some of this cordial support is due to the pride which the Kansas City people take, and have always taken, in any commendable enterprise originating here, but we are also satisfied that most of it is due to genuine appreciation of a work which every intelligent citizen must admit has been called forth by the literary and scientific tastes of the people of the city itself. The fact that the principal contributors to the Review have been our own fellow-citizens and that their articles have been copied from it by most of the prominent scientific periodicals of this country and England show this to be so; and the large and increasing attendance at the monthly meetings of the Academy of Science also shows it beyond question. In fact, despite the most remarkable engrossment of the entire male population in business, we do not believe there is a city of its size in the West where there are so many gentlemen in the various professions and departments of trade who manage to find time for some scientific and literary recreation, nor indeed so many who have distinguished themselves in the various fields of scientific investigation and research as well as in literary exercises.

To such a people it is only necessary to suggest that the Review is not, as yet, quite self-sustaining, to secure sufficient additional support to place it fully on its feet and enable its editor to do ample justice in the way of good work and fine illustrations to the excellent material offered him.

In future the Review will be issued at the commencement of each month, instead of on the 15th as heretofore. This will explain why the present number is for May and not for April, as it otherwise would have been.

Owing to the fact that the official business of the editor of the Review occupies all of his time during the day, rendering it impracticable for him to call upon all his friends in person, specimen copies will be sent out to many who are not now taking it, in the hope that upon examination they may be induced to subscribe. If those so receiving the Review do not desire to become subscribers, they will please return the specimen numbers; otherwise, it will be understood that they like it well enough to receive it regularly.

We are much gratified at the success our plan of giving premiums to subscribers has met with, and herewith reprint it, that all who desire to avail themselves of the offer may still do so, viz:

To any person who sends us $3.50, we will send the Review for one year and any $1.50 book published by D. Appleton & Co., S. C. Griggs & Co., Robert Clarke & Co., Houghton, Osgood & Co., Roberts Bros., or J. B. Lippincott & Co.

To any one sending us $3.75, we will send the Review for one year and any $2 book published by any of the above firms.

Persons desiring to subscribe for the Review and purchase any book or books or subscribe for any other periodicals published or obtainable in this country, can obtain special rates by applying to the editor in person or by letter.

It is also quite a source of pleasure that so many of our old subscribers are having their back numbers bound for preservation, and that so many of our new ones are ordering the first and second volumes. As before stated, all subscribers who have lost or missed

any numbers of the first or second volume can have them supplied *gratis* by the editor, and they can also have either or both years' numbers handsomely bound in half morocco and cloth sides *for $1 per volume.*

BACK NUMBERS.—To any subscriber for the coming year we will furnish the back numbers of the first and second year for $2.25 each set, bound, or $1.25 each, unbound.

WE shall publish in the next issue of the REVIEW a profusely illustrated archæological article, by Prof. F. W. Putnam, of the Peabody Museum, descriptive of his remarkable discoveries in Tennessee.

THE regular lighting of Monumental Park, in Cleveland, Ohio, with the Brush electric light, commenced April 29th, being the first regular public lighting with electric light in any city in the United States. The effect fully demonstrates its success. It gives three times more light than was formerly given by 110 gas-burners, there being only twelve electric lights used. The light, under contract, costs the city $100 per year less than the gas formerly used.

WE are under lasting obligations to Hon. B. J. Franklin for a copy of Walker's Statistical Atlas of the United States, a most valuable work of reference, and one which exceeds in comprehensiveness of plan and excellence of execution anything of the kind ever published.

THE article in this number of the REVIEW upon "An Eleven Years' Period of Sun-Spot Observations," is the work of the Quaker shoemaker-astronomer, William Dawson, of Spiceland, Indiana, a self-taught mathematician and observer, who, though dependent upon his daily toil for a living, has had the zeal and energy to partly earn and partly manufacture, with his own hands, a fine telescope, which is mounted upon his humble shop, and with which he has made observations in astronomy that have rendered his name well known among the best scientists of Europe and America. His is almost a parallel case with that of Thomas Edwards, the Scottish shoemaker naturalist, recently made famous by Samuel Smiles, and it is to be hoped that equal or greater good fortune may overtake our astronomer and put him in condition to prosecute his favorite study untrammeled by the cares of bread-getting.

THE address of Dr. Fee before the Kansas City Academy of Science, March 25th, upon "The Science of Language," was a most interesting and scholarly production, and gave great pleasure to his audience. Being largely oral, we regret our inability to present it to the readers of the REVIEW.

That of Prof. B. F. Mudge, the veteran geologist of Kansas, at the April meeting, upon "Mines and Mining," although of entirely different character, was listened to by a full house with great attention and interest. Prof. Mudge uses no notes, and his manner of delivery is remarkably free and pleasant—almost conversational.

The Monthly Summary of scientific progress is becoming quite a feature of the Academy meetings, and those of Prof. Parker, at the March, and of Rev. Dr. Roberts, at the April meeting, were models in their way.

THE lecture on "The National Yellowstone Park," by Prof. W. I. Marshall, to be given at Coates' Opera House, May 9th, will be, beyond question, the most acceptable entertainment ever offered to the intelligent people of Kansas City, and the Academy of Science deserves the thanks of the community for securing for them so great a treat. Aside from Prof. Marshall's fascinating style as a lecturer, the stereopticon illustrations are absolutely superb, being from photographs of all the wonders of that marvelous region, taken by a thoroughly scientific and artistic operator, under the most favorable circumstances, and handled in the most skillful manner by Prof. Marshall's competent assistant.

THE third annual meeting of the Kansas City Academy of Science will take place on the evening of the last Tuesday in May, at which time an anniversary address will be delivered by Rev. James Marvin, Chancellor of the Kansas State University; officers elect-

ed for the ensuing year, and other appropriate exercises.

THE London *Monthly Journal of Science*, one of the standard scientific periodicals of the old world, has again complimented the REVIEW by copying from its columns the able article of Prof. Nipher, of St. Louis, on "Our Conceptions of Physical Law," published in the January, 1879, issue. As this is the third time in less than one year that it has borrowed an article from us, we feel constrained to regard it as very flattering to so young and so Western a journal.

THE May number of *Harper's Magazine* is very richly illustrated, containing over 100 engravings that may confidently challenge comparison. The illustrated subjects offer unusual opportunities for picturesque treatment. Among the very many excellent articles, none exceeds in interest to the lover of art that upon "The Study of Art in Boston"—an admirable and comprehensive treatment of the subject by George P. Lathrop, with twenty-eight fine illustrations. After showing what, and by what methods, the student in the Boston schools learns of Art, the remainder of the paper is a description of the Boston Art Museum, with its principal and subsidiary art schools. William Blaikie's paper on "The Risks of Athletic Work" is timely and important — well worth the thoughtful perusal of all college students and others who are liable to be carried away by the recent tide of muscular strain which is upon us. The "Editor's Easy Chair," besides much that is interesting in the way of social and literary gossip, has a timely discussion of the present outlook of the question of international copyright. The "Literary Record" is ample and incisive. The "Scientific Record," with its full review of scientific progress, meets a want not otherwise as well ministered to in current literature; and the "Editor's Drawer" contains a rich fund of amusement for every class of readers.

THE discussion in the *North American Review* for May of the question of "Law or Design in Nature," by such able, learned and liberal men as Prof. Newcomb, Prest. Noah Porter, Rev. James Cook, James Freeman Clarke, D. D., and President James McCosh, is one that must necessarily be productive of good in settling the hitherto irreconcilable points of difference and questions of belief between scientists and theologians, from the fact that they will be compelled to state the points under discussion plainly and clearly to start with, and to confine themselves to them afterward. It will also be a means of driving off many of the bugaboo notions of certain good people who seem afraid to have the long revered teachings of the Bible ventilated and examined under the light of late scientific discoveries.

The article on "Recent Progress in Applied Science," by Prof. Henry Morton, is highly interesting and readable.

WE learn from *Science News* that Prof. J. H. Allen, of the Zoological Museum at Cambridge, Mass., has a work in press upon the Primipedia or "fin-footed" marine mammals, such as the sea-elephant, whales, seals, walruses, dolphins, etc., which is the most elaborate that has ever appeared upon the subject; giving classification, description and geographical distribution of each species, as well as geological history of the group. This is a department of science never before fully written up, and we await the appearance of the work with great interest.

FROM the three numbers of the *Index Medicus*—edited by Dr. John Billings, U. S. A., and Dr. Robert Fletcher, M. R. C. S., of England—which have been received up to this time, we are satisfied that it will be a most useful and valuable work to physicians everywhere, and we know that its preparation in so good a form must be a very laborious task for its editors and compilers. Washington, D. C., $5 per annum.

BOTH the *United Service*, which is a handsome magazine, devoted to military and naval matters, and *Sunday Afternoon*, to which we have several times referred as the best thing of the kind published in the country, contain strong articles on arctic exploration and the

Howgate scheme of progressive colonization of the polar regions. This subject deserves the attention of Congress, and will doubtless receive it before the close of the session.

THE *Archives of Medicine* is a new bi-monthly journal of 112 pages, edited by Prof. E. C. Seguin, M. D., assisted by Drs. T. H. McBride, M. D. Mann and L. H. Stimson, with an able corps of collaborators. Published by G. P. Putnam's Sons, New York; $3 per year.

ROBT. F. CLARKE & CO. send us a pamphlet containing two lectures written by Gen. M. F. Force, the first on "Some Early Notices of the Indians of Ohio," and the second entitled "To What Race Did the Mound-Builders belong?" both of which show much research and original speculation; and the latter especially will be of great interest to archæologists and is an important contribution to the literature of the pre-historic period.

THE *Atlantic* for June will be a number of extraordinary interest. It will contain a study of a "New England Factory Town," by the author of "Certain Dangerous Tendencies in American Life;" a sharply critical paper on "Wood Engraving and its Corruptions," by Mr. W. J. Linton, the greatest living master of the art; an essay by Charles Dudley Warner; a literary study by T. B. Aldrich; an abundant installment of "Irene the Missionary;" a very striking story of New England life in one number; a humorous story of Southern life; a sketch by W. D. Howells; a criticism of the exhibitions of the Artists' Association and the National Academy; and other tales, sketches, articles and poems, besides very full "Contributors' Club" and "Literary Notices."

PROFESSOR BARFF's article in *Van Nostrand's Magazine* for May, on "The Treatment of Iron to Prevent Corrosion," is one which should be widely read by iron manufacturers, and its principles applied to every article manufactured by them, especially such as are to be exposed to the action of the weather. From the examples given by him it is evident that he has hit upon a perfectly successful and feasible plan for accomplishing a long-looked-for desideratum in the mechanical arts.

THE *Popular Science Monthly* begins its fifteenth volume with the May number, which contains at least its usual amount of first-class articles. Messrs. Youmans have built up this journal under great difficulties, but it has now become one of the essentials to every reading man's study table, and they and the publishers are reaping a suitable reward.

OWING to the sad bereavement of the genial Permanent Secretary of the A. A. A. S., Prof. F. W. Putnam, he has been prevented from activity in arranging the preliminaries for the Saratoga meeting. He therefore delegated his powers to Prof. H. C. Bolton, of Trinity College, Hartford, and to Prof. D. S. Martin, of Rutger's Female College, New York City, as a committee of two. Dr. Bolton's previous experience in these matters will be of the greatest benefit to the Association as well as to the local committee at Saratoga, whose President is Dr. R. C. McEwen, and Secretary Prof. H. A. Wilson.

The Saratoga meeting begins August 27th, and a very large attendance is expected. The Appalachian Club, the Entomological Club, and the Anthropological Association meet at Saratoga at the same date, and their members will swell the numbers attending the Association.

WE are indebted to W. A. Lee, Esq., of Winfield, Kansas, for a sketch of a spinal vertebra and portion of a rib of a mastodon discovered in Sumner county by Dr. Cooper. The bones were found about two feet under ground, but apparently the original surface had been about thirty-three feet higher than at the time the discovery was made. The vertebral bone is about ten inches in vertical height and eleven across from process to process, and not less than three and one-half inches thick. The rib was traced about eight feet, but as this measurement exceeds anything of the kind hitherto described, it is probable that the trace represented two ribs lying together.

KANSAS CITY

REVIEW OF SCIENCE AND INDUSTRY,

A MONTHLY RECORD OF PROGRESS IN

SCIENCE, MECHANIC ARTS AND LITERATURE.

VOL. III. JUNE, 1879. NO. 2.

ARCHÆOLOGY.

ARCHÆOLOGICAL EXPLORATIONS IN TENNESSEE.

BY PROF. F. W. PUTNAM, PEABODY MUSEUM.

During the month of September, 1877, as stated in my general report (p. 203), friends in Nashville tendered to me such facilities for archæological research in central Tennessee as enabled me to make extensive explorations in several localities, the results of which are briefly recorded in the following pages.*

My first examination of the ancient stone graves, which are so numerous in the state of Tennessee as to form a marked feature of its archæology, was in the pre-historic cemetery of Zollicoffer Hill. It was soon found, however, that the

* Prof. Joseph Jones, in his elaborate and interesting work, "Explorations of the Aboriginal Remains of Tennessee," Smithsonian Contributions, No. 259, 1876, gives much valuable information about the archæology of the state, and describes and figures many articles found in the graves. In this report I do not intend to enter into a discussion of the facts, but simply to give the results of my own explorations in Tennessee. This limitation is also advisable for the reason that large collections, made under my direction, have been received from the state since the close of the year covered by this report, which will be referred to in the next Annual Report. I must, however, state that it was most gratifying to me, on reading Prof. Jones' work, which, though dated 1876, was not received at Cambridge until October, 1877, after my return from Tennessee, to notice how our similar explorations had led to the collection of nearly identical material, and of the corroboration I had obtained of many of the facts which Professor Jones has so well presented; although, as would be expected from two persons having nearly identical material in hand, but looking upon the evidence furnished from different stand points, I am forced to differ from him in some of his conclusions, particularly so in regard to the evidence of syphilis prevailing in this old nation of Tennessee. Undoubtedly very many of the human bones show the results of disease, but it may be that the disease was not syphilis, and that other diseases effect the bones in a similar manner.

graves at this place had been so much disturbed as to make any work done here rather unsatisfactory as to results. The building of Fort Zollicoffer on this hill was probably the first cause of disturbance of the cemetery, while its easy access from Nashville has recently led many curiosity hunters to the spot.

One of the graves at this place had been opened by a friend a few days before my visit, and in it he had found the remains of what he believed to be a mother and child. The few bones he collected and kindly gave to me, however, showed conclusively that while those belonging to the adult had been long buried, and were probably those of the body for which the grave had been made, those of the infant were on the contrary of a much later date, and were evidently of a child that, not many years ago, had been placed in this old grave, which was near the surface and formed a handy place for burial. This fact is mentioned simply to show the caution with which such examinations must be made in order to secure trustworthy results.

One grave which I opened at Zollicoffer Hill, though only a few inches under the surface, had escaped former disturbance. This grave was formed of six slabs of stone on one side and five on the other, with one slab at the head and one at the foot; forming a grave five feet eight inches in length, inside measure, and six feet outside; the average width being eighteen, and the depth sixteen inches. The side stones were unevenly broken to dimensions of eight to fifteen inches in width by about twenty inches in depth, and two or three inches in thickness. The two stones forming the head and foot of the grave were larger than those on the sides. All these stones extended a few inches below the floor of the grave, which was made by placing thinner and smaller pieces of stone in such a manner as to form a level bottom to this cist. Five slabs of stone, larger than those on the sides, rested on the nearly even edges of the upright stones, and, slightly overlapping, formed the cover or top of the grave.

Further examinations in other localities showed that all the stone graves were made after this plan, the only variation being in the size of the stone slabs and in the dimensions of the graves. Any rock was used that could be easily detached in slabs of convenient size. The most common to the localities I visited were limestone and sandstone.

In the grave I have described, the body had been laid on the back and extended at full length, occupying nearly the whole length of the grave, showing that the person when living was about five feet five inches in height.

From many measurements of graves taken during my explorations, I am convinced that the people buried in these stone graves in Tennessee were of ordinary stature. Occasionally a grave seven feet, and even eight feet in length, was found, but in such cases there was always a space of several inches between the bones of the feet and the foot-stone, and between the skull and the head-stone.

In the grave specially mentioned above, the only articles found were fragments of two vessels of clay, which had been placed in the center of the grave, and a pointed implement made of deer's horn (11830).

In another grave of the same character and about the same size, located by the side of the first, and also with the covering stones in place, the remains of the skeleton of an adult were found, and with it, in about the center, on one side of the skeleton, were the fragments of an earthen dish. On the breast of this skeleton was the ornament of copper here figured of its actual size (Fig. 1). The cross-like form of this ornament may give rise to the question of its derivation; and had any article of European make, such as glass beads, brass buttons, etc., so common in Indian graves subsequent to contact with the whites, been found in any one of the hundreds of graves which I opened in Tennessee, I should consider the form of this ornament the result of contact with the early missionaries; but, from the total absence of articles denoting such contact, I think it must be placed in the same category with the "tablet of the cross" at Palenque, and be regarded as an ornament made in its present form simply because it was an easy design to execute and one of natural conception.*

Fig. 1.

11832

Ornament of Copper, from grave on Zollicoffer Hill. Natural Size.

The ornament is evidently made from a piece of native copper hammered and cut into shape. The small perforation at the upper border still contains a fragment of the string by which the article was suspended, preserved by the action of the copper; and on one surface of the copper are slight evidences of its having been in contact with a finely woven fabric, thus showing that this ancient people, who were well advanced in the ceramic art, also possessed the knowledge of weaving.

On the estate of John M. Overton, Esq., eight or nine miles south from Nashville, there was formerly an extensive cemetery, and many graves are still to be found about the hill on which stands Mr. Overton's hospitable residence, known as the "Traveler's Rest." At this place Prof. Joseph Jones obtained many of the articles which he has described and figured in his valuable work.

It was my good fortune to receive the kind attentions of Mr. Overton during a short visit to this interesting locality, and, thanks

*Prof. Jones mentions finding the cross represented in several instances upon articles of shell and of copper found in the graves he examined, and has discussed the question of its origin. (1 ch., p. 77.)

to Mrs. Overton, and her gardener, Mr. Edward Cross, I was made the recipient of several very valuable specimens which had been taken from graves on the place, and also had an opportunity to open two graves myself, from each of which I secured pottery, and from one a cranium.

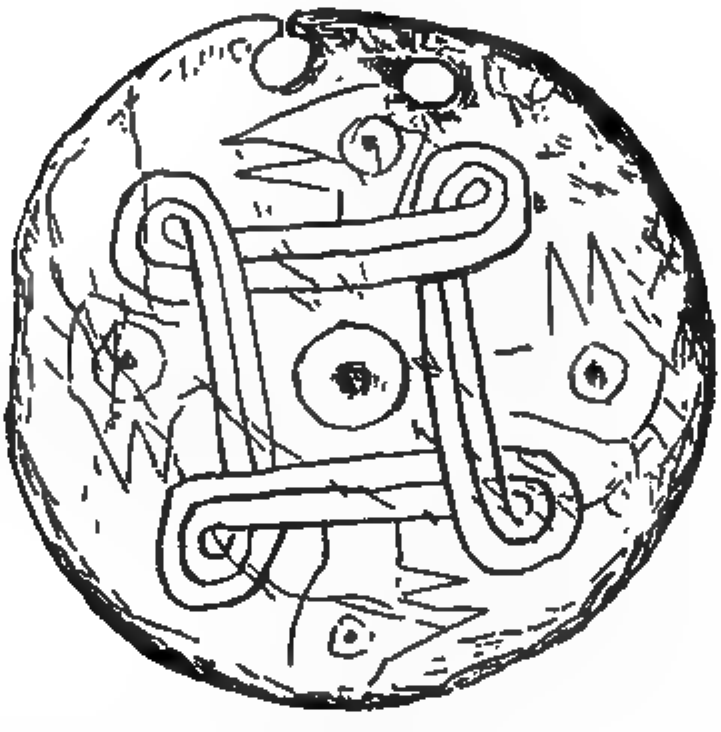
One of the articles of pottery (11835) is here represented, of one-half of its natural diameter (Fig. 2). This is a well made, rather thick dish, without ornamentation, and was found by the side of the skull.

Fig. 2.

Dish from grave on J. M. Overton's place. ½.

A short time before my visit, a stone grave was removed by Mr. Cross, and in it were found two interesting articles which he gave to me. One of these is a highly polished discoidal stone, two and a half inches in diameter and one and one-quarter thick, made of white quartz (11818); the other is the shell ornament here represented, of actual size (Fig. 3).

Fig. 3.



Ornament of Shell from grave on J. M. Overton's place. Natural Size. (11817)

This ornament is made from a large marine shell, probably a ***Busycon***, and is symmetrically carved on the slightly concave surface, as shown in the figure.

The four heads of birds, resting on the rectangular central figure, are represented by simple incised lines. Two holes near the edge of the disk indicate that the ornament was suspended.*

Mr. Cross also gave me a spear, or arrow-point, of jasper, with serrated edges (11819), which is represented of actual size (Fig. 4). This flint-point was found while cultivating the land in the vicinity of the graves, and with two polished celts (11816), presented by Mrs.

*Since this was sent to press there has been received at the Museum, from Mr. E. Curtiss, half of a shell disk found on the surface in Humphreys county, Tennessee. This shell disk has carved upon it figures identical with those on the one described above from Overton's farm. The two localities are between seventy and eighty miles apart, and at both places the number of stone graves indicates large settlements. Can these carved shells be regarded as totems? Several distinct patterns are now known, of each of which two or more examples have been found.

Overton, were probably once inclosed in graves which had been destroyed in former years.

In connection with the shell ornament found in the stone grave on Mr. Overton's place. I give the following illustration (Fig. 5) of a similar ornament (11801), which was given me by the venerable Col. J. D. Morgan, of Nashville, in whose possession it had been for some time. Col. Morgan was not certain that this ornament was taken from a stone grave, though the probability is that it was so found, in the immediate vicinity of Nashville. This disk is made from the shell of *Busycon*, and is larger than the one given me by Mr. Cross. Figure 5 represents this ornament, of one-half its diameter, and will give a better idea than words of the design carved upon it. Like the other, it has two holes for suspension.

Fig. 4.

Flint-point from Mr. Overton's place. Natural size.

Prof. Jones has described and figured (p. 43, figs. 7 and 8) a shell disk, found in a stone grave on the banks of the Cumberland, opposite Nashville, the carving on which is identical in its design with that on the one here figured, the only difference being in the number of circles in the two groups. In Prof. Jones' specimen the outer ring contains fourteen circles, and the inner nine, while in our specimen there are thirteen and six respectively. The central spiral figure is the same in both.*

Many of these carved disks of shell have been found in the graves and mounds of Tennessee and Missouri, and, with the identity of the associated pottery from the two localities, go far to prove the unity of the people, notwithstanding some slight differences in burial customs.

Fig. 5.

Ornament of Shell from Nashville. ½.

On the farm now owned by Miss Gertrude Bowling, about four and a half miles southwest from Nashville, were five burial mounds, which, thanks to the kind permission of Miss Bowling, were thoroughly explored. Of these, I personally conducted the work on one of the largest, which was about fifty feet in diameter and be-

* In relation to this central figure, Prof. Jones has ventured, on p. 187 of his work, a comparison between what he calls the "Symbolic divisions of the circle by the ancient stone grave race and mound builders of Tennessee," and the "Chinese figure Taeheih."

tween five and six in height. A second and part of a third were examined by Mr. Curtiss under my direction.*

These five mounds, containing the graves of from six to eight hundred persons, were probably the burial places of a former settlement in the immediate vicinity, all other traces of which had long since been destroyed by the cultivation of the land. Not far from this locality, as I was informed, are the remains of a cemetery where the graves were located on the side of a hill. A well known mineral spring is situated within a half a mile of the mounds, and a small winding creek is near by. The locality must have been a desirable one for a permanent village, and, like all other such sites met with in the state, was well chosen for the natural advantages offered.

In the mound which I explored, over two hundred bodies had been placed, with one exception, in stone graves of various sizes. The single exception of a body buried without the care which was used in all other burials in the mound is of interest, especially as there was no indication that any article had been placed with the body, and while engaged in carefully getting out the skull of this skeleton, I could but feel that it was that of some poor outcast, who had not been considered worthy of a stone grave. The skull of this individual is noted in the table of measurements, on p. 224, under No. 11918, and belongs to the ordinary type of skulls from the graves.

The mound itself was formed by several irregular layers or tiers of stone graves, the lowest of which had probably been placed irregularly round the grave first made. These lower graves were formed by making an excavation sufficiently deep to support the side-stones of the grave, but not so as to cover the overlying top-stones, at all events not more than an inch or two. On the graves offerings of food, etc., probably had been left, which would account for the many fragments of pottery, the several stone implements and other articles found upon the covering stones, and by the sides of the graves.

Below several of the graves, near the center of the mound, and, as nearly as could be determined, on the original surface of the ground, was a bed of ashes several inches deep, in which fragments of pottery and a few bones of animals were found. In at least two of the mounds near this, corresponding beds of ashes were noticed. Over this bed of ashes were several graves, the stones of which they were formed extending but a few inches into the ashes, thus showing that these stone graves were often formed above ground. After these early graves were covered by a few inches of soil, a second tier was placed above them, and eventually this was followed by a third and fourth.

At the highest point of the mound a few graves were found, which, though nearly destroyed by the growth and falling of trees, probably belong to the latest, or fifth tier of graves.

Over the mound was a recent growth of trees, the largest of which was a black walnut, standing on the very center with its roots reaching down the sides

* Major Powell and his party explored the other mounds.

of the mound and penetrating some of the upper graves. This tree was eight feet four inches in circumference at its base, and seven and one-half feet at a height of four feet; but as a section of the trunk only showed between sixty-five and seventy rings of growth, the tree is not of value in estimating the age of the mound, for it is historically known that this region was without Indian inhabitants one hundred and fifty years ago, and, uncertain as we are as to the period when they were constructed, it is certainly safe to state that the mounds were not made after that date.

The mound, formed in the method stated, by the gradual accumulation of the stone graves, was conical in shape, as each irregular tier of graves had a smaller number than that below it. The lower graves were thus, of course, the oldest, though there was little difference in regard to the condition of the bones, and the contents of graves side by side in any of the layers were in entirely different degrees of decay.

It was noticed that no method was followed in placing the head of the body in any particular direction, though in the lowest tier the majority were placed with the head toward the center of the mound, but even among these oldest graves one was occasionally found at right angles to that adjoining, In the upper layers, the graves were placed in all directions; sometimes one would be found lying lengthwise directly over a grave below it, and others were resting crosswise upon two, three or even four graves in the tier below. It was particularly noticed that, without regard to the proximity of other graves, each was constructed perfectly independent of those adjoining, notwithstanding the fact that the side or head stones of adjoining graves were often in contact. Generally, however, there was a space of about six inches between the graves, and often the space was one or two feet.

The following transcript of my field notes, for two days of the six that I spent with my diggers in examining this mound, will give sufficient details to show the character and contents of the graves in this and the adjoining mounds. In designating the several tiers, the lowest is counted as the first, and so on to the fifth, or most recent. The graves here recorded were principally on the eastern side of the mound.

Grave 1. 1st tier. Inside measure, 6 feet 9 inches in length, 1 foot wide, 9 inches deep. An adult, body extended, lying on back, head to west. Bones of skeleton very dry. Skull taken out perfect, but fell to pieces in cleaning, pieces saved with all the teeth. Took out large bones, part of pelvis, vertebræ, etc. Fragments of a pot, a broken arrowpoint, and three flint chips in grave. Top of grave covered by four large slabs which projected over the sides.

Grave 2. 1st tier. A child of four or five years, body extended, head to west. Skeleton all gone except portions of the left parietal and occipital, several teeth and piece of femur. No article in the grave. Length 3 feet 9 inches, width 11 inches, depth 9 inches. Side rocks extending several inches below the bottom of inside of grave. Two rocks on top.

Grave 3. 1st tier. Grave of an old person, body extended, head to west, 6 feet 9 inches long, 1 foot 8 inches wide. Skull, pelvis and long bones taken out in good condition. Nothing but skeleton in the grave.

Grave 4. 1st tier Adult, body extended, head to west, 6 feet 6 inches long, 2 feet 2 inches wide. Took out skull in pieces, long bones, fragments of pottery and shell of Unio.

Grave 5. 1st tier. This grave, though 6 feet 6 inches long and 2 feet 1 inch wide, was that of a youth or a woman of delicate frame. With the exception of portions of the long bones, the skeleton had nearly decayed. No articles in the grave.

Grave 6. 1st tier. 3 feet long, 2 feet 5 inches wide. A young child, all the bones decayed except the shafts of the long bones of arms and legs. No articles in grave.

The grave of an adult, designated as No. 1, was between the two graves of children, Nos. 2 and 6.

Graves 7 and 8. 3d tier. These graves were close together, of same size, the indications being that they were made at the same time. Each grave was 2 feet by 1 foot 4 inches, and each covered by a single slab. No. 7 contained bones of an infant in such position as to show that the body had been extended when placed in the grave. Several of the bones in a good state of preservation, and were saved. In this grave found fragments of pottery and a mussel shell.

In No. 8, the bones of the head and body were in a compact mass of 12 by 6 inches, and had the appearance of having been buried in a bundle. In this grave were also fragments of pottery.

Grave 9. 1st tier. 7 feet long, adult, long bones, pelvis and under jaw saved. A ring of pottery 1½ inches in diameter resting on under jaw.

Grave 10. 1st tier. That of a child, 3 feet long, 1 foot wide. Part of skull and the long bones saved. No articles in grave.

Grave 11 1st tier. Adult, 7 feet long. Skull and long bones saved. No sign of pottery or articles of any kind.

Grave 12. 2d tier. Long grave. Skeleton too far decayed to save any portion. No articles in grave.

Grave 13. 2nd tier. 3 feet 8 inches long, 14 inches wide, 9 inches deep. A child about five years old. Long bones and under jaw saved. No articles in grave.

Grave 14. 3rd tier. 2 feet long, 9 inches wide, 7 deep. That of a child. Portions of the skull and long bones saved. No articles in grave.

Grave 15. 2nd tier. 7 feet long, 11 inches wide, 6 inches deep. Adult, body extended on back, head to north. Skull, long bones and pelvis saved. The following articles were found in space between the skull and headstone:

Large spear point and knife of flint, several flint chips, two awls made of deer's horn, and two others made of bone, a shell bead, tooth of a beaver, tooth of a carnivorous animal, wing-bone of a bird.

Fig. 6

Fig. 6

Grave 16. 2nd tier. Next west of 15 and of about the same size, head to north. Long bones and jaw saved. Fragments of pottery.

Grave 17. 2nd tier. Old person, head to west. Skull, long bones, pelvis and other bones saved. Two flint chips in grave. No signs of pottery.

Grave 18. 3rd tier. Small grave containing portions of much decayed skeleton of a youth. Shell of Unio, and a flint chip in grave.

Grave 19. 4th tier. On the western side of the mound and the upper tier at this place. The covering stones of this grave had been disturbed. Head to west, feet toward center of mound. Nothing saved.

Grave 20. 1st tier. In part under Nos. 15 and 16. Youth of about 18 years. Jaw and arm bones saved. A slender flint drill, fragments of pottery and a few flint chips in grave.

Grave 21. 1st tier. About in center of mound and running north and south. 6 feet long, body extended, head to north. Skull saved. No articles in grave.

Grave 22. 1st tier. 6 feet three inches long. In same line with 21, and the headstones of the two graves in contact. Head to south. The skull and some of the long bones saved. Flint chips in grave.

Grave 23. 1st tier. Grave of a child, 3 feet 2 inches long, 12 inches wide, 5 inches deep. Head to west. Bones much decayed. None saved. No articles in the grave.

Grave 24. 1st tier. On the same line with grave 23. Footstone of 24 in contact with headstone of 23. Two tiers of graves over 23 and 24, the graves resting on 23 and 24 lying east and west, while those in the upper tier were lying north and south. The position of this grave and the condition of its contents, mark it as one of the oldest in the mound, though on the eastern side of the center. The grave was very dry and the bones had nearly all been reduced to dust. What remained consisted of a few teeth, a fragment of the femur, small fragments of the tibiæ and portions of the spongy part of a few of the bones. A pipe made of pottery and a few flint chips, were found near the teeth, and had evidently been placed near the head.

From these notes it will be seen that from comparatively few of these old graves can either crania or other bones be obtained, and those that are removed require long and patient work. It will also be noticed that very few graves contained pottery or other articles, though this would not indicate any neglect on the part of friends, as it is probable that many perishable articles were placed with the dead in the graves, while the numerous fragments of the pottery, the stone implements, etc., found among the graves, as already noticed, suggest that offerings were placed over the graves, as well as within them.

On the southern side of this mound, owing probably to its being always comparatively dry, the pottery was in a better state of preservation, and numerous perfect specimens were obtained from the graves. In two instances, one on the southern, and the other on the western side of the mound, there were double

Fig. 7.

graves. That is, two bodies had been placed in a grave of the usual length, but wider than ordinary. In one of these, the skeletons were extended at full length and crossed each other, the skulls being at opposite ends of the grave. In the other the skeletons were side by side, but one of them was without the bones of the feet

In several instances the skeletons in graves which were about two feet square, were those of adults, and showed by the compact arrangement and confusion of the bones, which were out of all natural connection, that the bones must have been buried after the flesh had decayed. Such instances were probably the burial of bones brought from some other place.

The finding of two distinctly marked forms of crania from this mound, and other stone-graves, seems, to me, to show that while the ordinary form of the crania of this stone grave people was such as would bring them among the short-headed nations, they were, by intermixture with a long-headed people, often of the orthocephalic type, though individual variation would also cause many heads of a purely brachycephalic nation to pass into the orthocephalic. The presence of several dolichocepalic crania among the others that were collected from the stone graves, furnishes data suggesting the intrusion of that form.

Several bones collected in this mound show the effect of disease of some kind, and are such as would be generally called syphilitic; but several pathologists who have examined them unite in stating that they do not prove the existence of syphilis, as other diseases than syphilis might leave such effects.

The following summary of the collection obtained from this mound, in which about 250 persons had been buried, will convey an idea of the contents of the graves, and I may add that the other mounds on Miss Bowling's farm yielded a corresponding amount of material of the same character:

Portions of fifty-four different skeletons, including many long bones of arms and legs, six sets of pelvic bones, and twenty-five skulls; twenty-four whole or nearly perfect vessels of pottery, nine lots of fragments of pottery from the graves, fifty-nine pieces of considerable size picked out of the dirt outside of the graves; nine stone implements from the graves and seventeen outside of them; eight lots of flint chips from as many different graves; two awls made of deer's horn, four made of bone; four teeth of animals, two of which were perforated for suspension; two shells of turtles; one wing-bone of a bird; one animal bone; all from graves; six spoons made out of shells of fresh water mussels (*Unionidæ*), thirty shells of Unionidæ and five lots of *Melania*; two lots of small shells, *Olivella*, perforated; four small lots of shell beads, all from graves; one pipe, made of pottery, from a grave; two rings made of stone, found in one grave, and one made of pottery, found in another.

The pottery is generally well made, though some vessels are much ruder than others. It is usually of a dark gray color, and composed of clay mixed with finely pounded mussel shells. As a rule very little attempt at ornament was made on the vessels from this mound and others adjoining, and only one of the peculiar

Fig 8.

Jar from Stone-grave Mound, Miss Bowling's farm.

human-shaped vessels, so characteristic of the pottery of this class, was found in the mound. This water vessel, or "idol" as these vessels representing the human form have been designated, is of special interest from its very rudeness of construction and the manner in which the hair or head-dress is represented. The two views of this vessel (Figs. 6 and 7), representing the front and profile, of natural size, give a far better and more accurate idea than could any description. As will be noticed in figure 7, the opening of the vessel is at the back of the head, and the woman is represented as resting on her knees. This rude attempt in plastic art must not be considered as a fair example of the artistic capabilities of this people, for there are several other vessels modeled after the human form, in the collection from Tennessee now in the Museum., and among them is not one so rude and uncouth as this. In direct contrast to this grotesque figure are the two beautiful and symmetrical vessels here represented (Figs. 8 and 9), one-half their diameter. These jars are made with care and skill; their good proportions and well made curves equaling, and closely resembling in outline, some of the best of the early forms of the Old World which were produced by the aid of the wheel, while their very simplicity is perfection of the art. Smooth and well finished, and standing firm and steady, they are in every way superior to the usual vessels of this character which have been taken from the graves and mounds of the southwestern states, as shown by the two following examples of the ordinary

Fig. 9.

Jar from Stone-grave Mound, Miss Bowling's farm. ½.

type (Figs. 10 and 11). The vessels represented by 8, 14 and 15 were taken from graves in mound 2, on Miss Bowling's place; all the other figures, here given, represent those found in graves, in the mound of which special mention has been made in the preceding pages.

Fig. 10.

Vessel from Stone-grave Mound, Miss Bowling's farm. ½.

Another and very common form of vessel from the stone graves, is represented by figures 12 and 13. These are comparatively well made cooking pots, furnished with holes, through which strings were probably passed, by which the vessels could be suspended.

By far the most common of the vessels found in the graves, are cooking pots, of various sizes, furnished with two handles. Many of these are rudely made and resemble the two toy vessels which are shown, of actual size, in figures 14 and 15. Others are nearly symmetrical and of more graceful shape, as shown by figures 16 and 17. Still better, and exhibiting a higher degree of workmanship, is the one represented in figure 18.

Fig. 11.

Vessel from Stone-grave Mound, Miss Bowling's farm. ½.

Figure 19 expresses an early style of ornamentation, consisting of a line of punctures, which give relief to the waved outline of the body of the vessel just below the neck.

Other forms of vessels were also found in this mound, some of which were dish and bowl-shaped, like those figured farther on, from the Lebanon mound, and the one from Mr. Overton's, represented by figure 2, which is a common shape. Among the fragments from outside the graves, and particularly in the ash bed, were several of a thick and rude character, evidently of large cooking pots.

(*To be Continued.*)

THE ANTIQUITY OF MAN.*

BY REV. L. J. TEMPLIN.

The doctrine that man had existed on the earth only about 6,000 years had been so long believed and so universally accepted that there seemed to be little or no disposition to call its truth in question. But this quiescence has been rudely startled by the announcement that recent research has brought to light human relics and fossils that demand for their explanation a lapse of time amounting, according to some, to tens of thousands, and, according to others, to hundreds of thousands of years. It is not the part of wise men either to accept or deny the truth of statements purporting to be based on facts, without a careful examination of the facts in question. While the fact that a new theory or doctrine contravenes old-established opinion is no justification for its hasty rejection, it is a good reason why all the facts in the case should be subjected to the crucial test of the most searching investigation. In approaching the subject of the duration of man on the earth, therefore, we should strive to divest ourselves as far as possible, of all prejudice arising from education or association, and give to every fact bearing on the question a fair, candid, but critical examination, and accept the conclusions that fairly result, whether they accord with the notions we have previously entertained or not. An investigation of the subject, in the spirit I have indicated, will doubtless require a modification of those views that regard man's existence on the earth as not exceeding less than 6,000 years, allowed by the Usherean chronology, while those that hold a period of human existence amounting to many hundreds of centuries will have to abate much from their claim to so great an antiquity for the human race. While making this concession, I do not wish to be understood as detracting one iota from the divine authenticity and truth of the biblical record. What is commonly received as the "Bible chronology" is only man's uninspired inference from certain genealogies that we have reason to believe are not, and that probably were not intended to be, perfect. Our interpretation of these Scriptures may require revision to correspond with the facts of science as well as the true meaning of the record, as has been the case in other instances.

The evidences of the pre-historic existence of man in Europe and America consist of relics of various rude manufactures, such as rough pottery, stone implements, broken bones and shell heaps; of rough drawings of extinct animals, and of human fossils, either in ancient geological strata, or in connection with the remains of certain extinct animals. The human period is divided into three ages, designated by the kind of material used in the manufacture of weapons and implements, as the Stone, the Bronze and the Iron ages. The Stone age is also divided into the Paleolithic, the Reindeer and the Neolithic eras. The first of these indicate a time when the manufactured implements were rudely

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made of unpolished stone; in the last, they were of polished stone, with other evidences of a more advanced state of civilization. The Reindeer era seems to have been a period when a second glacial condition drove the animals and people of Northern Europe southward, where many of them left their remains embedded in the sedimentary deposits of that time. Some of the oldest relics of man are found in certain peat-beds of Denmark. These vary in depth from ten to thirty feet. In these, at various depths, are found embedded the fallen trunks of different kinds of trees. At the greatest depth are found logs of the Scotch pine—*Pinus Sylvestris*—a species that was extinct in that region at the beginning of the historical time. This was followed by a sessile variety of the common oak, and this by the common beech, the only one known in history to belong to that region. Beneath the logs of the Scotch pine, at the lower part of these bogs, certain stone implements have been found that seem to prove that man existed there at the time this timber flourished in that region. How long a time it would require for the growth and disappearance of these successive forests, and for the accumulation of these beds of peat, we have no means of knowing; but that a few thousand years would give all the time needed, appears highly probable, from the rate at which such changes are taking place at the present time.

Another class of memorials of man's early existence in Northern Europe, is found in the shell-heaps, "kitchen middens," found along the shores of the various Danish islands. Some of these mounds are as much as 1,000 feet long, 200 feet wide, and ten feet high. They are made up of the shells of oysters, cockle, and other mollusks, together with the bones of various existing animals, and of birds and fishes; and occasionally scattered through these are flint hatchets, knives, and other instruments of stone, bone, horn and wood, with pieces of pottery, but no bronze nor iron.

Similar shell-mounds are found in the United States, from Maine to Florida, and in the Mississippi Valley, especially near Keokuk and Cedar Rapids, and on the Des Moines River, in Iowa. These consist of the refuse of such mollusks and other animals as are found in the adjacent waters. That these last are of very ancient date, we have no satisfactory evidence; but that those of Europe reach back to a very remote antiquity, is inferred, from two facts: First, that these mounds are not found along the shores of the Western Ocean where the waves are continually eating into and carrying away the land and burying it in the depths of the sea; where it is inferred shell-heaps were formed as where they are now found, but by the continual attrition of the waters they have disappeared. Second, the shells found in those heaps are thrice as large as the same species existing at the present time in the adjacent waters of the Baltic. From this fact it is inferred that at the time their contents were used as human food, the ocean had a much freer access to the Baltic than at present, and that by elevation the oceanic waters have been so cut off, that the fresh waters of rivers flowing into that sea so predominate as to stunt the growth of these animals and reduce them to one-third their original size.

Whether the facts warrant the conclusion of so high an antiquity as has been claimed, is difficult to determine.

These mounds may have never existed on the shores where they do not now exist; or, if they did, four or five thousand years may have been sufficient for every vestige to have been swept into the sea.

The explanation given of the reduction in the size of the molluscan inhabitants may not be the correct one; a scarcity of food or degeneracy from some other cause may have produced the reduction in size. But if the cause assigned is the true one it does not necessarily prove an antiquity for the people whose feasts furnished the refuse for these heaps anything like so great as has sometimes been claimed. Of this I shall have something further to say hereafter, if space permits. Certain bones dating back to a period previous to the glacial epoch have been found bearing marks and scratches that have been thought to be the product of human hands. But on examination it was found that the same strata that contained these marked bones also held the fossil bones of certain carnivorous animals and fishes, whose teeth leave on the bones they gnaw just such marks as those under consideration. So Miocene and Pliocene man suddenly disappears. Various rudely chipped bits of flint supposed to be intended to serve the purpose of hatchets, knives, spear-heads, etc. have been found at various places on the Somme and Seine rivers in France, and also at Hoxne in Suffolk, England. These are associated with the fossils of an extinct elephant, rhinoceros, lion and cave hyena, besides those of some animals yet living. It has been supposed that the juxtaposition of the bones proves that man was contemporaneous with the other animals named. But there are many doubts about the nature, relations and time of life of these flint chips. Some maintain that they are not of human workmanship at all, but only the result of the action of frost on the quartz rocks. Others admit their human origin but claim there is no satisfactory evidence that human beings lived at the time the animals did. And doubtless, great weight is to be given to the objections to the contemporaneousness of man with these extinct animals. The remains are found in the old bed of the river with every indication that they were deposited under the violent action of water, hence it is reasonable to suppose that the various relics have been washed from entirely different strata, and after being mingled together have been deposited in one common grave.

But while there are reasons for believing that the flint implements of Abbeville, Amiens, and other places fail to furnish evidence of the contemporary existence of man and extinct animals, in other cases there is no room for doubt of this fact, as in some instances, the remains of man are so related to those of extinct animals as to preclude the possibility of doubt that these animals lived in Europe contemporary with man. This is proven in the case of the Menton man whose skeleton was not only surrounded, but covered many feet deep with the remains of the cave bear, cave lion, cave hyena, and others. Without pursuing these particulars further I may sum up my conclusions, from a careful examination of the various facts bearing on the question, as amounting to a conviction

that man came in at the close of the glacial epoch, that he witnessed the retreat of the glaciers from central Europe; that he has seen the Scandinavian peninsula and the British Isles united by solid land to the continent of Europe with the Thames as a tributary to the Rhine; that he has seen the elephant, the mammoth and many other now extinct animals in their native haunts in Europe; and finally that Mongoloid man crossed from Asia to America on an isthmus in the place now occupied by Behring's Straihts. I am aware that such announcements naturally bring up the idea of vast geological time, of which fifty or even hundred thousand years would prove an entirely inadequate measure. We think of these events as belonging to the dim past, beyond the reach of our ordinary methods of computing time. But have we not assumed this vast distance of time rather than proved it? Have we not mistaken darkness for distance, and assumed that our ignorance on this subject was really knowledge? Because vast geological changes have taken place since the Champlain epoch was ushered in, it has been inferred that a time of immense duration has elapsed since the retreat of the ice of the Glacial Epoch from southern and central Europe. But aside from the imaginings of men, what evidence have we of this vast time? The reign of ice has not entirely ceased in our own day.

The ice fields that the Stonefolks saw, perhaps on the Rhine, we witness in Siberia, northern Russia and Greenland. The glaciers still linger amid the peaks and higher valleys of the Alps and neighboring ranges. In our own country their retreating footsteps are still seen among the gulches of the Sierra Nevada and Rocky Mountain ranges, and their buried remains are still found in huge masses of ice in the ice wells of Vermont, New York and Wisconsin. With these evidences before us is it unreasonable to suppose that a few thousand years have been sufficient for the removal of these fields of ice from the low lands of central Europe to their present localities? The same I think may be affirmed of the geological changes that seem to have taken place since man's advent in Europe. It will not do to relegate all these to the distant past, for we are living in the midst of these changes, many of which are slow and uniform while others are catastrophic in their nature. Many gradual elevations and depressions of special localities are going on during our own age. Southern Italy has been subject to vertical oscillations of twenty feet or more within historic times. The Andes have been depressed 220 feet in the last three-fourths of a century. The northern part of Sweden is undergoing gradual elevation. Many changes of this nature are now going on at various localities along the eastern coast of North America. More sudden changes, that produce greater changes in a few hours than the above noticed will in as many centuries, have occurred in quite recent times. We have seen the whole coast of South America lifted up ten or fifteen feet and let down again in an hour. During an earthquake in 1819, 2000 square miles in southern Asia sank and became an inland sea, while adjacent to it a belt of country fifty miles long and in places ten broad was lifted up ten feet above its former level. With regard to the coast on the Baltic we have evidence of a very important

depression since the existence of man. While digging a canal near Stockholm, the workmen came upon a fishing hut at a depth of sixty feet. And as this subsidence is still going on, it seems to stand in corroboration of the theory that at no very distant day, as compared with the immense lapse of time claimed by some, that region stood many feet higher than at present.

Having shown that the geological changes that appear to have occurred since man's advent into the world do not necessarily require such a remote antiquity for their explanation as some have supposed, we next inquire what evidence is furnished of the great antiquity of the human race by this co-existance of man with extinct races of animals. Until quite recently, no evidence existed that man was coeval with any of these extinct races, and it was therefore assumed that they were of very high antiquity; and when it was found that the remains of man and extinct animals existed in such juxtaposition as to prove their contemporaneousness, instead of exciting suspicion that an error had been committed in assigning so high an antiquity to these extinct animals, it was thought to be necessary to carry man back to the remote ages when they are supposed to have lived. But wherefore? Why carry man back instead of bringing the animals forward? There is no necessary reason for assigning animals to a distant antiquity simply because they are now extinct. We are witnessing the extinction of species at the present time. The Maories of New Zealand retain traditions of the extinct birds of their islands. The Dodo, of Madagascar, now extinct, was alive 250 years ago. The Solitaire and the Æpyornis have become extinct in modern times, as has also the whale, once so abundant in the Bay of Biscay. The great Auk, of Newfoundland, and the Labrador duck, seem to have disappeared within a few years past. The American Bison, that but a decade of years ago grazed in countless herds over these plains, and even on the spot where this flourishing city now stands, is rapidly approaching extinction, and unless the government speedily inaugurates some efficient measures for its protection, this noble beast will soon have disappeared from the face of the earth. Now, if, as these facts prove, races of animals are becoming extinct during our own times, the fact that human fossils are found buried in the same grave with many extinct animals of Europe, may just as readily, and with as much show of reason, be explained on the supposition that these animals existed at a comparatively recent period of time, as on the counter-supposition that man existed in the remote ages that have been held by some. The facts in the case do not seem to demand for their explanation a lapse of time so great as to do any great violence to the opinion that has so long obtained on this subject.

An argument much insisted on in favor of the great antiquity of the human race is drawn from the fact that Egyptian monuments prove that about as great divergence between the races had been reached 3,000 or 4,000 years ago, as are found to exist at the present day. It is held that if the 4,000 years that have elapsed since the pictures of the different races were drawn on the

walls of Egyptian temples have produced so little perceptible change as we see, it would require an incalculable number of years to produce the differences that we find existed at that time. This has led many eminent men to the conclusion that the different races are distinct species, and as such, have originated at different times and places. But a law is now coming into very general notice that is capable of explaining the great differentiations that have taken place, without demanding so great a duration of time. It is "that species when first introduced have an innate power of expansion, which enables them to rapidly extend themselves to the limits of their geographical range, and also to reach the limits of their divergence into races." Under the operation of this law, when a new type of animal is introduced it is speedily differentiated into the most diverse forms and characteristics of which it is capable, after which these divergent forms or races will run along in a parallel existence until, by unfavorable changes in the environments, they one by one drop out and become extinct.

Numerous illustrations and proofs of this law might be cited from the fossil history of the past, but lack of space forbids it here. Under the operation of this law, man, when first created, would speedily reach the limits of his capacity for divergence into races; and after having reached these limits the resultant races would continue a parallel existence to indefinite time. Supposing the sons of Noah to have been subject to this law, with possibly this tendency to divergence in a particular direction in the case of each, intensified by inherited peculiarities in their wives, and we have all the conditions essential to the production of all the race differences that are shown by the most ancient of Egyptian records, even assuming that the human family has existed but 6,000 or 7,000 years. There appears to be no necessity for the immense lapse of time that some have felt called upon to assume to explain the differences that exist in the races of mankind.

A similar argument to that based on the existence of different races of men, has been drawn from the great diversity of languages that is found among men. Thus, it has been assumed that languages have been formulated in the order of their complexity of structure. According to this theory, the great families of language have appeared in the following order: 1st, the Chinese; 2nd, the oldest Turanian formation, or Thibetan; 3d, Hamism, the language development of ancient Egypt; 4th, Semism; 5th, the highly perfected and harmonious organisms of language, or Arism. Such is supposed to be the order of evolution in language, resulting in the symmetrical and highly specialized organisms found in the Arabic, Sanscrit, Greek and Latin. Assuming the above to have been the order of development from the simple monosyllabic language of China to the highly complete forms of the Aryan languages, and assuming further, that the slow changes that are taking place in living languages, are a fair measure of the rapidity with which such changes proceeded in the earlier history of languages, the deduction is arrived at that the time essential to the evolution of these highly complete forms of language is to be recorded not by thousands nor even by tens of thousands, but by hundreds of thousands if not millions of years.

But is such a corollary a necessary deduction from the facts in the case? What evidence have we that these languages have followed each other in the order of increasing complexity as antecedent and consequent, or rather as parent and offspring? The declaration is a bare assumption, not only destitute of affirmative proof but also antagonized by numerous facts bearing on the question. As a matter of fact we find all these varieties of language existing coetaneously at the present time. Living representations of all these great linguistic families may be still found in existence. Nor does history show that any of these great families of language ever sustained the relation of parent or offspring to any other. What we find to be contemporary, and to have been so throughout historic time we are under no obligation to believe were ever consecutive. Several modes of linguistic progress may have run their course contemporaneously in the world, their characteristic differences being due to the peculiar genius of the different races of men. The theory that language has grown up by development and accretion from the most simple articulate expressions of emotion, may be the only method that science can take cognizance of, yet it may be true, nevertheless, that instead of being the result of this painful and slow process of development, language was at first received by direct communication from a source of superhuman knowledge. In any case we do not find, in the present structure nor in the past history of language, anything to warrant the assumption of a very remote antiquity of the human race. We have no standard by which we can measure the rate of development or differentiation of a language during its early history, hence, all conclusions drawn from such speculations are fallacious and unreliable.

I have now passed over the ground covered by the discussion of this question, and have given my reasons for the opinions expressed in the beginning of this paper, viz: That the existence of man on the earth, probably extended farther back into past time than the limit assigned in the most popular chronology of the present day; but that the claim for the human race of an existence reaching back through many decades of centuries, seems to be based upon erroneous interpretation of facts, and hence to be destitute of adequate support of proof.

In conclusion, I may say, that there is so wide a difference of opinion among savans, both as to the facts and their interpretation, that it is quite too early to announce any positive conclusion upon the subject, and the honest inquirer after truth may well hold his judgment in reserve and wait for further development of facts.

ASTRONOMY.

MARS INHABITED, LIKE OUR OWN EARTH.

When, sixteen years ago, I published the last edition of my work—"The Plurality of Inhabited Worlds"—I did not expect to see the speedy confirmation which the progress of astronomy was to give to my essay, by allowing us, so to speak, to put our finger on the manifestations of planetary life. On one hand, those samples of other worlds—the aerolites—have brought us, in their composition, certain elements which play a very extensive *role* in life—such as oxygen, hydrogen, chloride of sodium, and carbon. The aerolite which fell at Orgueil (Tarn-et-Garonne) in 1864, brought us a coaly matter—carburets that are due, like peat, to vegetable remains; the one which fell at Lancé (Loir-et-Cher), in 1872, brought us salt. They had already brought us water in the form of hydrated oxide of iron. The worlds whence these fragments come do not differ, then, essentially from our own. On another hand, by means of spectrum analysis, there has been discovered in the atmospheres of the planets, watery vapor identical with that which produces our fogs, our clouds, and our rains. But of the studies made during these later years, the telescopic examination of the planet Mars offers the most immediate confirmation of the existence of life beyond our globe. This neighboring world, indeed, presents analogies of the greatest similarity with our own. By its situation, we are permitted to observe its surface under the best of conditions for study, and the telescope detects configurations which denote the closest relationship of this globe to the one which we inhabit.

It was through the continued and persevering study of the movements of Mars that Kepler discovered the laws which govern the system of the universe. To me, it seems certain that it is through a study of this same planet the theory will be confirmed which will prove the philosophic crowning of astronomy—that of the plurality of worlds. By this double service Mars will have merited the esteem of thinking humanity, and will, perhaps, be able to have those follies and cruelties pardoned with which the god of war has so long inspired the poor unreasonable *genus homo* which people our earth.

Led by a persistent desire to find in practical astronomy itself a direct demonstration of this great truth of the plurality of worlds, I have specially occupied myself with observations of the planet Mars. I have studied it very particularly at those periods when it passed in close proximity with the earth, in 1869, 1871, 1873, 1875, and 1877. On comparing one with another, of the observations made by different astronomers, I have succeeded in collecting together, in this respect, numerous and decisive documents. The results of these observations and discus-

sions are satisfactory for the solution of the curious problem as to the state of life on the planets. I propose to bring them together here in a special study of the world of Mars, and I hope they will interest all those whose thoughts sometimes love to quit the material interests of earth to soar toward the mysteries of the unknown—toward those silent worlds suspended, like our own, in space, and which seem like so many interrogation points placed in the heavens to excite our curiosity and sympathy.

Our readers are aware that the planet Mars comes next after our own in the order of distance from the sun. Our orbit is traced at 95,000,000 of miles from the sun, and that of Mars at 145,000,000. When the two planets are both on the same side of the sun, the difference that separates them is then only 50,000,000 miles; and this may even decrease to 35,000,000, because neither Mars nor the earth moves in a circular orbit, so that their distances from the sun increase or diminish according to epochs.

In order that the observations of Mars may give good results, two conditions are requisite, besides that of its relative proximity at the time of its apposition: the atmosphere of the earth must be pure at the place of observation, and the atmosphere of Mars must not be cloudy. In other words, it must be while the inhabitants of the latter planet are enjoying fine weather. In fact, Mars is surrounded, like our globe, with an aerial atmosphere which, from time to time, becomes covered with clouds just as our own is. Now these clouds, in stretching out above the continents and seas, form a white veil which hides them from us totally or partially. The study of the surface of Mars in this case is difficult or even impossible. It would be as useless to attempt to distinguish this surface when it is cloudy weather on Mars, as it would be to try to distinguish the villages, rivers, roads and railroads of our country from a balloon while sailing above an opaque stratum of clouds. From this it will be seen that the observation of this planet is not so easy as one might at first suppose. Moreover, the purest and most transparent terrestrial atmosphere is usually traversed by cold or warm currents of air, flowing in different directions above our heads; so that often, during the calmest night, it is almost impossible to make a passable drawing of a planet like Mars, the image seen in the reflector being wavy, tremulous, and confused. In spite of these troublesome conditions, the planet Mars is the best known of all.

The moon alone, on account of her proximity, the constant transparency of her rare atmosphere, and the absence of clouds, has been the object of a more assiduous and more particular study, so that her geography to-day is completely determined. But, after the moon, Mars is the best known of all the stars. No planet can be compared with it in this respect. Jupiter, the largest, and Saturn, the most curious (both more important than Mars and more easy of observation in their entirety, on account of their dimensions), are enveloped in an atmosphere constantly loaded with clouds, so that we never see their surface. Uranus and Neptune are only brilliant points. Mercury is almost always eclipsed, like court-

iers, in the radiance of the sun. Venus, Venus alone, might be compared to Mars. She is as large as the earth, and consequently twice the diameter of Mars. She is nearer us, and may even come within 25,000,000 miles of us. But she has one fault—that of gravitating between us and the sun, so that, at her nearest proximity, her lighter hemisphere being naturally always on the side toward the sun, we see only her dark hemisphere bordered with a narrow crescent (or, more correctly speaking, we do not see her). The result is that her surface is more difficult of observation than that of Mars. So she is in this respect excelled by the latter, which, of all the sun's family, is the individual whose acquaintance we shall form most quickly.

We have already been able to study and map the geography of Mars. The most striking thing on a first examination of the general appearance of this planet is that its poles are, like those of the earth, marked by two white zones—two caps of snow. Both the north and south poles are at times so brilliant even that they seem to extend beyond the edge of the planet, in consequence of that well known effect of irradiation which makes a white circle appear larger to us than a black one of the same size. The ice varies in extent; it becomes heaped up and extends around the poles during winter, while it melts and retreats during summer. Its entire mass occupies a greater superficial area than our polar ice does, and sometimes extends down as far as 45° of latitude; that is, to regions which would correspond to the situation of France on the earth.

At first sight the planet seems to bear some analogy to our own, as regards the division of its climates into frigid, temperate and torrid zones. An examination of its topography shows us, on the contrary, quite a characteristic dissimilarity between the configuration of this globe and that of our own.

In fact, upon the earth there are more seas than lands; three-fourths of our globe are covered with water. It is not the same with the surface of Mars, notwithstanding that attempts have often been made to apply such comparisons to its continental and oceanic divisions. Water does not cover three-fourths of this planet, for there is almost as much land as sea, and the seas are mediterranean. Moreover, several narrow seas, true channels, afford communication between the different latitudes. The continents of Mars are of a yellowish-red shade of color, and its seas present themselves to our eyes under the appearance of grayish-green blotches, their color still more heightened by the effect of contrast with the reddish color of the continents. It is this prevailing color of the land which gives to the planet that ruddy light by which it is at all times distinguished from the other planets and from the fixed stars.

The color of the water on Mars appears, then, to be the same as that of terrestrial water. As for the land, why is it red? It was at first supposed that this tint might possibly be due to the atmosphere of the "warrior planet." It in no wise follows that because the air of our own world is blue, that of other planets should be of the same color. It might be possible to suppose, then, that the atmosphere of Mars was red; and the poets of the planet would, therefore, extol

this glowing shade. Instead of diamonds sparkling in an azure vault, the stars there would be glowing fires blazing in scarlet; the white clouds would be suspended in a red heaven, and the splendors of the setting of centupled suns would produce effects no less remarkable than those that we admire upon our sublunary globe, But there is nothing of this. The color of Mars is not due to its atmosphere; for, although this veil extends over the whole planet, neither its seas nor its polar snows come under the influence of this coloration; and Arago, by proving that the limb of the planet is less colored than the center of the disk, has shown that this coloration is not due to the atmosphere, for if it were, the rays reflected from the edges of the planet in order to reach us, having more air to pass through than those that come to us from the center, would be, on the contrary, more deeply colored than the latter.

Can it be that this characteristic color of Mars, so visible to the naked eye, and which is undoubtedly the cause of the warlike personification with which the ancients invested the planet, is due to the color of the grass and other vegetation which must cover its plains? Can there be red meadows and red forests up there? Can it be that trees with ruddy foliage offer a substitute there for our quiet and delightfully shaded woods; and are our scarlet poppies typical of the botany of Mars? It may be remarked, in fact, that an observer situated on the moon, or even on Venus, would see our continents strangely tinted with a greenish shade. But in autumn he would see this shade disappear in those latitudes where the trees lose their foliage, and afterward would see snow covering the country for entire months. On Mars, the red color is constant, and we remark it in all latitudes, during their winter as well as their summer. It varies only according to the transparency of its atmosphere and of our own. That is no obstacle, however, to the fact of the vegetation of Mars being the principal cause of this general tint. The ground cannot be everywhere bare like the sands of Sahara. It is probably covered with vegetation of some kind or other; and, as it is not the depths of the soil, but its surface, that we see, it must be that the surface-covering—the vegetation, whatever it is—has red for its predominant color, since all the land of Mars offers this same curious aspect. We speak of the vegetation of Mars, we speak of its polar snows, we speak of its seas, of its atmosphere, and of its clouds, as if we had seen them. Are we authorized to create all these analogies? In reality, we see only red, green, and white *blotches* on the little disk of this planet. Is the red indeed *terra firma*, is the green really water, and is the white indeed snow? In a word, is this truly a world like our own?

Yes! Now we are able to assert it. The appearance of Mars varies constantly. White spots move about over its disk, too often modifying its apparent configuration. These spots can be nothing but *clouds*. The white spots at its poles increase or diminish according to the seasons, exactly like our terrestrial circumpolar ice-fields, which would offer precisely the same aspect, the same variations, to an observer placed on Venus. Then these white polar spots of Mars are like our frozen water. Each hemisphere of Mars is more difficult of observa-

tion during its winter than during its summer, being often covered with clouds over its greater portion. This is also precisely what would happen to an observer from Venus, with respect to our earth. Every one knows that the sky is oftener overcast in winter than in summer, and there are entire weeks during which fogs or clouds prevent us from seeing the heavens.

PHILOSOPHY.

IS NATURE PERFECT?

FROM THE LONDON JOURNAL OF SCIENCE.

We have often thought it might be useful to exhibit, in all their well-marked contrast with the results of modern Science, those views of Nature which still prevail even among the cultivated classes, and which are very slowly retiring from the fields of literature. For this purpose let us take a man,—such as may be found in abundance in the middle and upper ranks of society,—well-educated, heedful, thoughtful, and refined, but not trained as an observer, and having no special acquaintance with recent discoveries in natural history. Let us give him a holiday, and send him for a summer ramble in the New Forest, in "merrie Sherwoode," or among the ferny coombs of Devon, and let us try the while to read his musings. Even his very first expression of feeling, the sigh of relief on finding himself rid of city-bustle, worry, and noise, is mainly the outcome of an illusion. He fancies himself in a sphere where boundless resources are dispensed with a liberality equally boundless. The heavens are full of light and warmth, and the earth is clad in rich and varied hues. Perfume breathes from every spray. On all sides is life, animal and vegetable, unworn by toil and unshadowed by care and anxiety. To the butterfly hovering over the blossoms, to the blackbird warbling on the spray, the world seems not as a man, the task-yard of a workhouse, but the banqueting-hall of a palace. The observer, even whilst he envies the insects and the flowers, who "toil not, neither do they spin," feels soothed and refreshed by the mere reflection of their supposed felicity.

Plenty requires peace as its natural complement, and our wanderer believes that he finds this boon also in the woodlands and the heaths. Indeed, how should it be otherwise? Where there is superabundant plenty, where every demand is more than satisfied, how should there be the thrusting, and pushing, and jostling, outward visible signs of that internecine war of each against all, and of all against each, which the "friends of peace" worship under the name of competition? The observer cannot, indeed, forget that in his realms of concord and repose, pain and death are present. He knows that at any given

moment hundreds of flies must be struggling in the snares of spiders; that caterpillars innumerable are being gradually devoured by internal parasites; that many a song-bird is falling a prey to the hawk or the weasel. But, as was the case half a century ago, even with eminent naturalists, he scarcely apprehends the full meaning of all this suffering and massacre. Such facts as we have enumerated seem to him mere "rude exceptions to the general joy," departures from the order of Nature, casual, even though numerous, rather than as they really are, part and parcel of its very essence. Our friend in his ramble, and in his necessarily hasty survey, fails to perceive that not only does one-half the animal kingdom live only in virtue of the death of the other half, but that the herbivorous creature is as much a life-destroyer as the beast of prey, extirpating other animals by depriving them of food, and plants by consuming their seed or their seedlings. He overlooks the silent, quiet, but not the less deadly war waged by plants among themselves, each seeking to monopolize to itself soil, air, and light, and to crowd out, starve, or smother its competitors. In short, in his optimistic contemplations, he entirely forgets that struggle for existence which—whether or not we regard it as a main factor in the development of animal and vegetable forms—we are bound to accept as perhaps the greatest, and assuredly the saddest, feature of the organic world. Who, after reading the third chapter of the "Origin of Species," can fail to be reminded of those words of St. Paul "For we know that the whole creation groaneth and travaileth in pain together until now;" * or of the sadder exclamation of one who, having no faith in the ultimate solution of this dark riddle, cries out in agony "Creation is murder!" †

But not only is strife rather than peace the order of the organic world,—strife so thoroughgoing and so wide spread that it rages even among spermatozoids; not only do the majority of seeds and ova, from one or other cause, fail to be developed; not only does every species press hard on its means of subsistence, or on the space where alone its being is possible. Even in matters where life is not directly concerned we find Dame Nature not lavish, not liberal, but more penurious than the wife of thriftiest peasant-proprietor in rural France. Those colors which so fascinate the poet or the artist, and which seem to be spread in such royal lavishment over copse and meadow and heath, have all their purpose to fulfill; they have to serve as an attraction to insects which effect the fertilization of the flower. The beauty and the odor which we so much admire appear only when this task is necessary, and when it is accomplished they are again withdrawn, just as at a banquet the lights are quenched and the decorations taken down when the guests have departed.

To a sensitive mind it must be saddening to find that the woods, the fields, and the solitudes offer no soothing contrast to the exchange, the workshop, or the battle-field, and that on earth peace, repose, and harmony exist nowhere. But it is the duty of Science to "perceive and declare" whether the facts and the laws recognized be joyous or grievous.

* Romans, viii. 22.
† WINWOOD READE, Martyrdom of Man.

In one sense, indeed, Nature may be called lavish. But it is an unkindly prodigality. She is reckless of life; reckless and wasteful, too, of heat, the prime condition of organic existence. Passing over the fact that the bulk of the solar radiation travels out into the desert depths of space, while an infinitesimal portion alone falls upon any of the planets, very much of the heat which reaches our earth, at least, is radiated off again during the night. Carbonic acid gas, indeed, possesses the precious attribute of admitting the sun's rays freely, and of being at the same time almost impervious to heat-rays of low tension, such as those given off by the earth. But this gas forms but a very small proportion of our atmosphere, and could not be sensibly increased, on account of its injurious action upon higher animal life. But if the non-poisonous gases, oxygen and nitrogen, had the same power as regards the radiation of heat, the climate of the world would be much improved, and spring frosts—the bane of the farmer and the gardener—would be rendered impossible. It is of course conceivable that some cause may exist which renders it impossible for oxygen and nitrogen to possess this attribute without forfeiting their characteristics in other respects.

There is another feature which, outside of scientific circles, we hear commonly ascribed both to the individual animal or plant, to the fauna and flora of any given country, and to the animal and vegetable kingdoms in their entirety. We refer to the attribute of "perfection." We must confess ourselves utterly at a loss to know how this notion has been reached. We have asked believers in this doctrine to tell us by what marks this perfection is to be recognized. We have invited them to take up a plant or an animal, and to demonstrate that any departure from or addition to its present standard, whether structurally or functionally, would be injurious. But the only answer we have received has been a cloud of generalities. The very idea of perfection seems to us unthinkable in reference to a crowd of species engaged, as all Nature is, in mutual conflict. It by dint of the imperfections of the Carnivora in speed, strength, or cunning that their prey—say the deer or antelope—escapes. It is in virtue of the imperfections of the latter animals that they are captured by the wolf or the leopard. Again, were all animals and vegetables perfect in themselves and in reference to their surroundings, we may ask how it comes that so many species have been exterminated, and that others are even now in course of extermination? It may be contended that the surroundings have altered. This, then, is an admission that the adaptation to circumstances is not always perfect. But, further, some other species, or at least groups, coeval with such as have disappeared, are still found surviving. Here we have consequently the following riddle to solve:—Two groups of "perfect" animals, each in "perfect" harmony with its surroundings, are given. These circumstances being altered, the one group is no longer in harmony, and consequently perishes, while the other remains equally well adapted to a different set of conditions, and survives! Yet more; admitting the perfection dogma, we must suppose the fauna and flora of any region—say New Zealand—better adapted to i s soil and climate, and to all other local condi-

tions, than any strange animal or plant can be. On introducing such strange species we should therefore see them placed at a disadvantage, and without constant human aid and supervision prove unable to exist at all. But in reality the very reverse is the case; the new comers are not only found able to exist independently of man's assistance, but to spread in opposition to his most strenuous efforts, and even to crowd out the natives. The notion, therefore, that every local fauna and flora forms a perfect whole, perfectly adapted to the circumstances in which it is placed, must be given up as a most glaring error.

Again, we often see large groups of closely-allied species, differing but little from each other, inhabiting the same country, dependent upon the same enemies. Thus there are in Britian alone fifty-seven species of the small dung-feeding beetles included under the genius *Aphodius*. Some of these are exceedingly abundant, others comparatively rare. If all these species are perfect, and perfectly adapted to environments, why should some be so much more plentiful than others? But, descending more closely to particulars, we may show that in animals, as in man himself, there are certain *desiderata*—wants which Nature has left unsupplied. How exceedingly uncomfortable should we, for instance, feel if we were suddenly deprived of the power which we now enjoy of excluding the light from our eyes when we think proper! Yet as regards the sense of hearing we labour under a similar deficiency; it might rather be said under a greater, since to all persons who have occasion to concentrate their thoughts upon some given subject noise is a far greater nuisance than light can ever be to a healthy man. Surely, then, our inability to render ourselves temporarily and voluntarily deaf is a proof that we, in one respect at least, fall short of perfection.

We may take another instance: what a great addition would it be to man's comfort if he were personally offensive to all insects of the Dipterous order, so that they would keep aloof from him in disgust! When we consider that the mosquito, in addition to the positive irritation, annoyance, and want of sleep which its attacks occasion, is now proved to be an agent in the spread of leprosy,—when we remember that the common house-fly is a propagator at least of ophthalmia, and probably of all zymotic disease,—we surely cannot dispute that such a change, either in the nature of our cutaneous emanations or in the tastes of these pests, would be an incalculable boon, lacking which we cannot proclaim ourselves physically perfect.

Did we know the necessities of other animals as well as we know our own, we might doubtless find in like manner defects on all hands. But we have surely said enough to lead the advocates of organic perfection—who often find in this dogma an *a priori* objection against Evolution—to pause and reconsider the the evidence upon which it is based.

The last of the popular assumptions concerning Organic Nature which we can here notice is the old, but still rampant notion that every plant, every animal, exists with reference to man, and for his convenience. "What use is such or such a creature?" is a question too commonly asked—and not by children

only—of the zoologist or the botanist When we reply that to the best of our belief and knowledge the animal or plant in question is of no use, but simply an unmitigated nuisance, the most charitable construction put upon our answer is that we are too proud to confess our ignorance. Like the doctrine of organic perfection, this dogma is not traceable to any substantial basis, but, having once become a current article of popular faith, its extirpation is proving a difficult task. To us it appears, in its very essence, irreverent. If the Creator had, *e. g.*, made the mosquito, or the guinea-worm, or the *Lucilia hominovora* to be of service to man, we may depend upon it that they would not have been sources of annoyance. Even a human invention, the produce of exceedingly finite reason, is condemned, if, along with certain and even great good, it effects abundant mischief. How much more if the good be problematic, and the evil open and palpable? Shall we, then, adduce what is notoriously defective as an instance of Divine "contrivance"? One thing we may certainly conclude, viz.: that if a maximum of earthly enjoyment and the minimisation of earthly suffering had been the objects of the Creator, the world would have assuredly have been constituted very differently from what it is. When we know what His objects really were it will be quite time enough to indulge in teleology and to indite "Bridgewater Treatises."

METEOROLOGY.

DETAIL REMARKS ON THE WEATHER.

ISAAC P. NOYES, WASHINGTON, D. C.

Men generally seem to think it more of an indication of wisdom to reject or oppose a newly revealed truth, than to accept it; at least they think that new ideas should find their way into public favor very slowly. Fortunately for the human race there are exceptions to this, and that there are always a few men who are quick to perceive a truth, and who at once make themselves ready to become its champions. Their task, however, is not always an easy one; on the contrary it is quite apt to become a thankless drudgery. It is again fortunate that there is such an enchantment about truth that its followers are ever willing to work for small pay—that the mere permission to work in some cause that is believed to be true and for the benefit of mankind is, with some few at least, a great favor.

Notwithstanding the number of years that observations of the weather have been taken, and very satisfactory results obtained, still, very few, outside of those immediately engaged in the work, will interest themselves in the causes that produce the results every day witnessed in the atmosphere about us.

Almost all departments of science have what may be termed exceptions; yet the word "exceptions" hardly presents a fair view of the subject, for these so-called exceptions are not really exceptions, but merely different phases of the subject. Under certain causes certain effects will be produced, but in nature there are always a number of causes working together; under some conditions one predominates, under other conditions other effects, etc. Though this law seems very easy to understand, still there are many people who seem blind to it, and they seem to think that there can be no deviation from the law as they understand it, and their idea of it is that it must have all the precision of an automatic machine, else there can be no value in it. They will not consider the fact that in all nature the strongest force will predominate, whether it be heat, cold, moisture, or dryness, etc. They seem to forget that though the blossoms have their time to appear in the spring, and do generally appear with much regularity from year to year, there are seasons when the heat, for reasons which may be readily understood by studying the weather maps, causes these blossoms to be a little earlier or a little later than common, and that when they appear too early, a cold spell of weather is apt to follow and injure the bud, so that the fruit is destroyed or greatly reduced in quantity. We are liable to have similiar irregularities in the weather department. People who have paid some little attention to the subject, yet not enough to be very earnest after the truth, will often accuse the weather bureau of error, and even doubt the correctness of the system. On the 8th, 9th, 10th and 11th of March, over a large portion of the United States we had a peculiar condition of the weather. In former articles I have referred to a law, resulting from the conditions of low barometer, or what may now well be considered a law, that north winds will be cold and south winds warm. In the vicinity of Washington, on the 10th of March, we had an apparent exception to this law as a whole. It was very warm on the 8th, 9th, 10th and 11th of March, especially on the 10th, and yet on this day the wind was all, or most of the time at least, from the north; first northwest, then northeast—still it was very warm. At first it seemed as though there was a mistake somewhere, for how could the above statement in regard to north and south winds and the center of law be accepted as a law in the face of such evidence to the contrary? To the meteorologist this was not much of a mystery, at least for more than a moment or so, for he knew how it must be—would the weather map support any plausible theory to account for what was by some regarded as one of the great irregularities of the weather, and the laws laid down in regard to it? It was well known on the 8th and 9th, that low barometer was on high line of latitude—up in Canada, somewhere beyond our line of observers. This would readily account for it being generally warm throughout the United States, but hardly for a north wind at Washington. The map for the 10th, which, by the way, is not posted until noon, explained the mystery. First, to repeat, *low* was on a high line of latitude. This warmed the atmosphere all to the north of Washington, so when other causes produced a local north wind it only brought back the warm air that had been heated

and drawn toward the north during the past two days. Previous to this another *low* had passed off the coast, and was out on the Atlantic ocean. These winds from the north were quite moderate, indicating that the center of *low* was not very concentrated. In the fore part of the day what little wind there was from the northwest, or better, in the direction of the southeast, was toward this what may be termed the *old low* that was out on the ocean. In the meantime the *low* that was up in Canada had developed a tongue-like prolongation, fully half way down into the territory of the United States. By the way, it is not an uncommon thing for regions of low barometer to be developed in this way. As the center of this *low* was far away, or not very positive, it was natural that a sub-center should develop in this tongue of *low*. This in the locality of Washington caused the northeast wind. Such winds, however, are merely local, and though from one quarter, in reality belong to another. Locally this was a north wind, yet in its general aspect it was a southerly wind with a local turn to the south, the same of the Mississippi river which at some local points courses to the north when the current of the river as a whole is toward the south.

Possibly some people may consider this merely an ingenious defense of a natural phenomenon after it has occurred, but fortunately the weather maps will bear witness to the truth of the statement, and it would be absurd for any one to maintain for an instant that it would be possible for these maps to be made to conform with any imaginary conditions of private individuals, who were interested in having certain effects accounted for in a way to please their notions of what ought to be the conditions to produce certain results. Possibly some people entertain such ideas, but a little familiarity with the subject would at once dispel any such notions. Truth is always consistent. An erroneous report could not be made to harmonize with all the complex changes that are constantly occuring. An intentional error of this kind would heap such disgrace upon the person making it as no respectable person could bear. But then no alarm need be apprehended in this matter, for only a fool would attempt it, and his foolishness would be so apparent to the world that his deception could not be carried out—it would only rebound upon itself and expose the ignorance of foolishness that would attempt it, and would be such a disgrace as no man of science would desire to be the author of. So we can depend upon the reports being honest and as correct as the limited number of observations will permit, and that no disturbance of the atmosphere can occur which cannot be satisfactorily explained by these daily maps. Though at first there may seem to be a lack of harmony between the weather and the record, the two will, on careful observation, be found to agree, and will make all exceedingly plain to those who will take a little trouble to examine the all facts.

PARADOXICAL PHENOMENA IN ICE CAVES.

BY N. M. LOWE.*

In the *Scientific American* for March 29th, last, there appeared a letter from Mansfield, Ohio, inquiring as to the cause of the phenomena in an ice cave which is to be found in Decorah, Iowa, and for which there appears to have been, as yet, no cause assigned. A description of this cave is given in the same letter, of which description, so nearly as is possible, the accompanying illustration is a fair representation, as regards the main features of the case.

There may be a few differences as regards the details of the cave, but so nearly as can be judged from the written description the drawing presents the elements necessary to the peculiarities of the cave. In the figure, the cave will be seen represented as at the bottom of an inclined passage, the inclination being that noted in the description, and the dimensions and other particulars being as nearly as possible to the proper scale. The crevice, mentioned in the description, may be imagined as a fault, which extends from the top of the cave to the top of the bluff, through which crevice, mingled air and water finds its way to the cave.

In regard to the mingling of air with a stream of descending water, a quotation from the pamphlet of Mr. Frizzel, on the subject of the compression of air by such streams, would not be entirely out of order. On this subject, he says,—

"It is a matter of common observation that bubbles of air rise in still water with a very moderate velocity. The velocity depends, somewhat, on the size of the bubbles. Bubbles, such as issue from an orifice one-eighth or one-tenth of an inch in diameter, rise from a depth of fifty feet in about fifty seconds, moving rather less than one foot per second near the bottom, and rather more than that near the surface. It is plain that a bubble of air drawn into water that has a downward motion of more than one foot per second, will be carried down and subjected, in its descent, to a continually increasing pressure."

Considering, then, the description and the facts above quoted, it would not be unfair to assume that there would be a possible compression of air contained in the water, on its liberation in the cave, of about eighty pounds to the square inch. This assumption is supported by the fact that from the description, the mouth of the cave would be at least eighty feet above the level of the river, and it may be inferred that as no special mention is made of the position of the entrance, save that it is in the side of a bluff, the hill may be considered as extending above the mouth of the cave to at least the distance of the latter from the river.

*Read before the Boston Scientific Society April 9, 1879.

The phenomenon, then, of ice being found there in the summer, can be referred, I think, to the theory of the liberation of compressed air brought down from a considerable height by a stream of water falling or flowing through a natural conduit or fissure in the rock, embodying the principle of the ancient and well known *tromp* used in the Catiline forge, and still in use in Corsica, Sardinia, Savoy, and many other places.

It is only necessary to imagine such imperfection in the conduit or fissure at the initial point, which is supposed to be on the top of the bluff, or far up the mountain's side, as would admit air to come in contact with the water after it had attained a velocity of more than one foot a second. When the air has reached the bottom and is liberated in the cave, it will be from a pressure equal to the height of the column of water, and it will have lost by *convection* in the mass through which the conduit passes, the heat *due to its compression;* and on being liberated, it will immediately absorb from the air and the water in the cave, the heat which it has lost in its downward passage.

"The most remarkable fact" that the cave freezes only in summer, and as the cold of actual winter comes on, the ice in the cave gradually melts and disappears, is caused, I will venture to state as an opinion, by the gradual freezing of the surface at the top of the bluff or the source of the air, to a considerable depth, thus sealing up the aperture through which the air entered the conduit.

Sir Roderick Murchison described a similar ice cave at Lletski, Russia, but gave no explanation as to the phenomena.

Ice wells are to be found at the foot of Mount Mansfield, in Vermont, and are really incipient caves, without depth enough to be clear of ice in winter, from the fact that the external winter temperature reaches the bottom or source of the summer ice.—*Science Observer.*

A NEW THEORY OF DEW.

Investigations which Prof. Levi Stockbridge has made at the Amherst Agricultural College, upon the comparative temperature of soil and air, and the disposition of dew upon the earth and plants, have led him to conclusions very different from those commonly received in regard to the formation of dew It is usually held that dew is the moisture of the air, condensed through contact with objects of a lower temperature, and that it does not form till radiation has reduced the temperature of the earth and other objects below that of the atmosphere. The experiments referred to seem to indicate that, as regards objects in the immediate vicinity of the earth, at least, the process is the converse of this, viz., that dew is the result of condensation, by the air, of warm vapor as it rises from the soil. The course of experiments from which this novel scientific theory was deduced is outlined below.

The basis of the theory is the discovery that in summer the average tem-

perature of the earth at night is higher than that of the atmosphere. The temperature of the earth in an inclosed space on a level with the surrounding soil, and the temperature of the air, were taken at the warmest time of day and the coldest time of night for several months, and the average temperature of the air for the season was found to be 72.940°, and that of the soil 72.061°. But the average temperature of the air at night was 49.664°, and that of the soil 56.370°, the earth thus averaging at night over 6° warmer than the atmosphere. The temperature of the soil and air at night was also taken at various points within ten miles of the college, on all kinds of grass land and bare soil, and in the forest, and the same facts were obtained, the soil being at all times warmer at night than the air.

These results led to experiments on dew-fall. Two boxes, each of a cubic foot capacity, were filled with soil without disturbing its particles or disarranging its strata; one receiving absorbent, retentive loam, and the other peat. These boxes were placed in a trench, in an open field, level with the surrounding ground, and exposed to the weather. Through the month of June they were weighed night and morning, and unless there was a rain in the night, they uniformly weighed less in the morning than at night, the loss being from one to three ounces for the loam, and one to four ounces for the peat. This, Prof. Stockbridge thought, indicated that the soil at night gave forth water, and that the moisture found on the surface of a field in the morning came from a deeper soil rather than from the air. Other similar experiments followed. In one a cabbage plant was inclosed in an air-tight tin case. Where the stem of the plant protruded through the top of the case, wax was used to make it impossible for moisture to escape through the leaves. The can was first kept within doors and weighed night and morning, when it always showed a loss during the night of 1.21 grams to 1.78 grams. When left out doors at night, with the can wrapped in cloths to prevent moisture reaching it, the loss was from .55 grams to 4.23 grams, showing a loss even when there was moisture or dew on the leaves.

These experiments, continued through the season, gave Prof. Stockbridge these proofs of his proposition that the dew on the ground in the summer is the condensation of vapor that rises from the earth: 1. The vapor of the soil is much warmer at night than the air, and would be condensed by it. 2. Vapor from the soil is soon diffused and equalized in the whole atmosphere, but in largest proportion when evaporation is taking place near the surface of the soil; and, other things being equal, plants nearest the earth have the most dew. 3. Dew under hay-cocks, boards, and like objects on the ground, could receive it from no other source.

METEOROLOGICAL SUMMARY FOR APRIL, 1879.

SIGNAL OFFICE, LEAVENWORTH, KANSAS, MAY 1, 1879.

The weather conditions during April were notably constant, and there were few features to distinguish it from April of past years.

The mean barometer of the month was 29.930, about .05 above the April mean. The highest barometer was 30.404 on the 3d.; the lowest2, 9.444 on the 9th. The pressure during the month was somewhat higher, and the range somewhat less than during the same month of several previous years.

The mean temperature of the month was 55.37°, being 3° above the April average. The highest temperature was 83°, on the 26th, the lowest 19.5°, on the 3d. This was the lowest April temperature recorded at this station during the past seven years. The greatest daily range was 40°, on the 5th, and the lowest daily range 10°, on the 14th and 30th.

The mean percentage of humidity during the month was 55.38. The April average is 60.80%. The ranges were not very great. The highest daily mean was 85.7% on the 14th; the least 28.3% on the 5th.

The total rainfall, during the month, was 3.57 inches, being eighty-three one-hundredths of an inch below the April mean. The greatest April rainfall, ever recorded at this station was 7.65 inches in 1876; the lowest, 1.67 inches in 1875.

The prevailing wind of the month was southeast. Total number of miles traveled during the month, 6,629. Highest velocity thirty-two miles, from the S. E. at 3:15 p. m., 8th. The records of Prof. Snow, at Lawrence University, show that, almost invariably, the force of the wind at that station is nearly double what it is here.

Two hundred and ten observations of the wind's direction were recorded as follows: N. 45 times; N. W. 27 times; W. 4 times; S. W. 4 times; S. 31 times; S. E. 46 times; E. 15 times; N. E. 28 times, and calm 10 times.

Number of clear days during the month 9; fair days 10; cloudy days 11, and days on which rain fell 13.

Among casual phenomana were noted Lunar halo's on 4th, 28th and 29th. Frost on 17th and 18th, and hail on the 6th and 29th.

Prof. F. Hawn, the well-known horticulturist of this city, reports to this office as follows "The condition of the fruit trees, in regard to the coming fruit crop, could not be definitely determined at the close of March. The winter was unusually severe on shrubs, trees and plants; not so much from the low thermal range as from the protracted low mean and other atmospheric conditions, such as relative humidity, ètc. March added greatly to the injury, as on the 7th the thermometer marked up to 83°, and for six days the mean was over 55°. This developed the buds to a vulnerable point, and started a flow of sap that proved fatal to many trees and shrubs. Following this came the low range of March

24th and 19th at 9° and 15° respectively, and the high ranges from March 25th to 29th inclusive, the thermometer on each day making over 70°, and on the 27th up to 84°. This warm wave was followed by another low range on April 3d and 4th, the minimum temperature being 19.5° and 21° respectively. The extent of the damage, produced by these great ranges of temperature, could not be then estimated, and which the blooming season of the latter part of April developed. Peaches, early apples, pears, apricots and Duke cherries will be almost a total failure, and many other species greatly damaged."

The following table will aid in a comparison of the past month with April of previous years:

Year.	Mean Barometer.	Mean Thermometer	Mean Humidity.	Total Rainfall.	Maximum Temperature.	Minimum Temperature.	Highest Barometer.	Lowest Barometer.
. . . .		deg's.	per c't.	inches.	deg's.	deg's.		. . .
1872	29.910	56 21	. . .	3.63	84	29	30.440	29.280
1873	29.851	48.60	62.40	5.07	85	26	30.262	29.315
1874	29.999	49.00	62.10	2.80	82	22	30.365	29.389
1875	29.961	49.80	55.20	1.67	82	23	30.345	29.546
1876	29.909	55.24	60.90	7.65	85	31	30.349	29.500
1877	29.838	53.30	64.90	7.14	80	25	30.476	29.112
1878	29.687	58.80	59.30	2.86	80	35	30.126	29.088
1879	29.930	55.37	55.38	3.57	83	19.5	30.404	29.444
Average of 7 Years.	29.879	52.99	60.80	4.40	82.6	27.3	30.338	29.319

SAMUEL W. RHODE,
Signal Corps, U. S. A.

MISSOURI WEATHER SERVICE—APRIL, 1879.

PROF. FRANCIS E. NIPHER, DIRECTOR.

April, 1879, has been cool and dry. The mean temperature, at the Central Station, has been 55.15° (normal, 56.1°). The extremes of temperature were 25° and 82.5°. Although the average temperature was but little below the normal, the minimum (25°) was unusually low for April. Engelman has, however, observed lower temperatures several times—as low as 18° in 1857, while in 1833, '43, and '55, the thermometer marked 93°.

The rainfall at the Central Station was 2.69 inches (normal 3.70 inches), while the rain for April, 1878, was 6.31 inches.

In the State, the rainfall was greatest (over 3 inches) in a belt reaching from near Hermann to beyond Sedalia, reaching a maximum of 4.33 inches at Sedalia.

Along the Missouri river, from Kansas City to Oregon, the rainfall also exceeded 3 inches. Over the greater part of the State, the rainfall was from 2 to 3 inches. In general, the deficiency of rain in the State, as compared with last year, is about 3 inches. The drouth occurring in the latter half of the month has extended over the eastern half of the State.

On the 14th, when the center of low pressure was near St. Louis, a rain began at noon near Chamois. This rain extended outward, with great regularity, in all directions, with a velocity of about 20 miles per hour, increasing in violence to the west and east, and diminishing to the north and south of Chamois, as is shown on the map to accompany this bulletin. The rain was accompanied with thunder and lightning, and, in the most cases, with hail. In the Mississippi bottom, a few miles east of St. Louis, several tornadoes were developed (at least *four*), the tracks of three of which intersected in the village of Collinsville, Illinois, at about 2:45 P. M., causing great damage. These vortices were unaccompanied by lightning, rain or hail. A careful study of these tornadoes has been made by Dr. J. L. Wadsworth, of Collinsville, and the results will be published in detail.

On the same day, at 3:15 P. M., a heavy wind from the southwest, lasting 3 or 4 minutes, with 0.2 inches of rain in 3 minutes, and hail enough to cover the ground, was observed at Centerville. The thunder accompanying was violent, and high in air, with no lightning visible.

The wheat crop is generally reported as very promising. Fruit, and particularly peaches, considerably injured.

Washington University, May 5, 1879.

WEATHER REPORT FOR APRIL, 1879.

BY PROF. F. H. SNOW, OF THE KANSAS STATE UNIVERSITY.

STATION—Lawrence, Kansas, corner of Tennessee and Pinckney streets; elevation of barometer and thermometer 875 feet above sea level, and 14 feet above the ground; anemometer on the University building, 105 feet above ground.

Mean temperature 56.4 degrees, which is 2.89 degrees above the April average of the 12 preceding years. Highest temperature 84 degrees, on the 22d; lowest, 20 degrees, on the 3d. Mean at 7 A. M., 50.03 degrees; at 2 P. M., 66.23 degrees; at 9 P. M., 54.73 degrees. The severe frost of the 3d, was very destructive to fruit buds of peaches, pears and early apples.

Rain, 4.18 inches, which is 0.96 inch above the April average. Rain fell on 10 days. There were six thunder showers and two light hail showers.

Mean cloudiness 49.67 per cent., the month being of just the average clearness. Number of clear days, 11 (entirely clear, 5); half-clear, 9; cloudy, 10 (entirely cloudy, 4). Mean cloudiness at 7 A. M., 53 per cent.; at 2 P. M., 51.33 per cent.; at 9 P. M., 44.67 per cent.

Wind—N. W., 22 times; N. E., 21 times; S. W., 16 times; S. E., 15 times; S., 7 times; E., 5 times; N., 3 times; W., once. The entire distance traveled

by the wind was 11,231 miles, which gives a mean daily velocity of 374.37 miles, and a mean hourly velocity of 15.48 miles. The highest velocity was 50 miles an hour on the 9th. On the 10th, the total run of the cups was 1,010 miles.

Mean height of the barometer, 29.062 in.; at 7 A. M., 29.084 in.; at 2 P. M., 29.033 in.; at 9 P. M., 29.069 in.; maximum, 29.467 in. on the 3d; minimum, 28 684 in., on the 14th; range 0.783 in.

Relative humidity—Mean for the month 61.0; at 7 A. M., 71.5; at 2 P. M., 40.8; at 9 P. M., 70.1; maximum, 96.5 on the 30th; minimum, 18.3, on the 4th.

GEOGRAPHICAL NOTES.

SECOND ANNUAL REPORT OF THE DIRECTORS OF THE GEOGRAPHICAL SOCIETY OF BREMEN.

TRANSLATED FOR "THE REVIEW" BY CAPT. H. W. HOWGATE, U. S. A.

The following is a recapitulation of our Society's operations in the past year:

The utilization of the results of our exploring expedition to Western Siberia, is most worthy of mention. As you will recollect from our last year's annual report, February 1, 1878, the collections are not only in Bremen, but also in Hanover, Hamburg and Brunswick, and have been brought to the notice of the German public in that categorical and concise order which so distinguished the Bremen Exposition.

The 51st assemblage last fall, in Cassel, September 11th to 17th, of the naturalists and doctors, gave rise to the conclusion to bring these collections before a larger circle of scientific men. The aid of the Scientific society in that city (and especially of its manager, Dr Hornstein) was thus secured.

Dr. O. Finsch again undertook the manifold duties of assorting and arranging the collections in the handsome apartments of the Royal Art Gallery (first floor, new building), which were tendered by the city authorities for this purpose, gratis. Our member, Capt. H. Sengstacke, offered in a most praiseworthy manner to assist Dr. Finsch in his laborious duties, and to act as representative for the society, during the whole duration of the Cassel Exposition, which lasted five weeks, and the attendance at which was an animated one.

Over 8,000 persons visited our Siberian Expositions at five German cities, and though the financial results show only an excess of 371 marks, after deducting all expenses, still we point with satisfaction to the result obtained, and which has been our sole aim, i. e. the dissemination of geographical knowledge. It may be mentioned here that the ethnographical collection has been enhanced by the addition of five photographs—in cabinet form—and two stereoscopes, which first appeared at M. G. Behrens' in Brunswick.

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A contract has been entered into with publisher E. Wallroth, in Berlin, to issue the work of the Siberian expedition, and which may be expected to make its appearance in about two months It will consist of forty sheets of print and fifty-six illustrations, thirty-five of which latter will occupy a full page each, and the remaining twenty-one will be printed in the text. These illustrations have been drawn from nature by Dr. Finsch, and will, therefore, be correct in the smallest details.

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Our society, according to last year's annual report, comprised 117 active, 9 corresponding and 9 honorary members. At present it consists of 146 active, 16 corresponding and 13 honorary members. Three died, viz: Drs. Meinertzbagen, Petermann and Kohl. The deplorable loss which science has sustained by the death of the two latter mentioned excellent geographers, has been commented upon by the press in a consistent manner.

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Not wishing to enter into details of geographical facts, which accumulated in 1878, still we must notice the unexpected result obtained by the Swedish Polar Expedition, which, according to last advices, after going north of Asia to the mouth of the Lena (August 27th), have pushed forward almost to the entrance of Behring's Straits, thus solving the one hundred year old problem of the north-east passage. It is hoped that the heroic members of that expedition will succeed this summer in steering their vessel safely to the shores of Japan. At all events, expeditions are being prepared by land and sea to trace them. Among the latter is our honorary member, Mr. Alexander Sibiriakoff, who has trusted the management of his new steamer "Nordenskjöld," to a German seaman i. e. Henry Sengstacke, formerly 1st Lieutenant of the German North Pole expedition vessel "Germania," and assuredly the difficult task of carrying the first vessel from the Atlantic Ocean to the mouth of the Lena could not have been trusted into better hands. Mr. Sengstacke is a practical seaman of long experience, and took a prominent part in the German North Pole Expeditions 1868-70. He is rendered competent also by numerous studies at the German Naval Academy to be the theoretical leader of an expedition which must furnish important nautical and hydrographical results.

Last year we had to record the death of our member, Edward Mohr, while on a new exploring tour to Central Africa. To-day we are forced to record another loss i. e, the death of Dr. Christian Ruterberg, of Bremen, in western Madagascar. This young scientist started last fall from Madzunga, accompanied by ten natives, to the western part of the Island. The sad catastrophe occurred in the Province Menski, as per dispatches received. The details of this tragic event are not known, as yet. It was Dr. Rutenberg's intention to return to his home after this last tour, and we had hoped he would assist in the labors of our Society and to so compensate, in a measure, for the two above named gentlemen who are now forced to leave Bremen.

ESQUIMAU DOG DISEASE.

In a recently published official document upon the results derived from the English Arctic Expedition of 1875–6, is an interesting paper on the Esquimau dog disease, by Fleet Surgeon B. Ninnis, M. D., of the Discovery, from which we extract the following portion:

"Twenty five apparently healthy dogs were embarked on board ship, in the middle of July, 1875, subsequently increased to twenty-seven by the addition of two young ones. We were given to understand that feeding twice a week was amply sufficient, that the worst possible personal treatment was too good for them, and that meat, in any stage of decomposition, was a perfect luxury to their fastidious palates.

Seven-and-twenty animals confined to a space which the utmost attention was scarcely sufficient to keep habitable, constantly quarreling and fighting for dear life, exposed to sun, snow, dew and wet generally, and without a chance of a run ashore, it was not to be wondered at that they began to show signs of disease. The first attacked was a young female, twenty-five days on board, and she had a fit and died in thirteen days. Others became attacked. One was summarily shot, one ran away and was seen no more, two were accidentally drowned, seven died from the disease, six recovered, and one died mad.

Of the whole number, twelve only were under medical treatment, one had rabies and died, one so far recovered as to have two litters of pups, and then died ten months after her first fit, and two or three days after her last litter. Two fell into the water when in fits and were drowned, two died notwithstanding everything that was done to cure them, and six recovered and were landed at Disco on our return.

The symptoms were disinclination to move, accompanied by a very contracted appearance of the loins, which, however, were not tender to the touch, tenesmus, and scaly, pitchy stools. These symptoms were followed in two or three days by a fit with foaming at the mouth. No disposition to bite.

As the disease progressed the fits became frequent and altered somewhat in character. Instead of lying quietly on their side only slightly convulsed, the fits lasted about a minute, then leaving the animal apparently as well as before. The animal now struggled violently, the head thrown far back, spine curved deeply in, the tail curled over the back almost touching the head, legs stretched out, teeth exposed, violent contraction of the muscles of the chest, rendering the cavity greatly reduced in size and thus arresting respiration.

These fits sometimes succeeded each other rapidly, and left the dog so exhausted as to be scarcely able to move, and he finally died in one of the fits. The post-mortem examination showed healthy brain, spinal cord, heart, lungs, liver, pancreas and kidneys. The chest in all cases was exceedingly contracted and the lungs collapsed, and in all cases where the intestines were examined, they were found to contain the pitchy substance noted above as forming one of the

earliest and most certain symptoms of the disease, and also ulcerations of the inner surface of the gut to the extent of at least four inches on either side of the ileo-cœcal valve, which, in some cases, was found covered with coagulated blood.

The treatment found most beneficial, and which I recommend, is, on the first signs of pitchy stools or tenesmus, give four grains of calomel, followed by croton oil, if necessary, and repeated at intervals until the stools become more natural. If there appear to be much uneasiness, or if the animal whines, I have given forty minims of solution of morphia, and kept him under its influence, repeating the dose every four hours if necessary.

As the patient is generally hungry, I prefer to keep him from roaming and give him the best of water and good food in small quantities and frequently. I think if taken at this stage, very few would die. As the disease advances, there is less time for the action of medicine, therefore, larger doses and more active measures must be used.

In conclusion, I consider the ulcerations on the intestines quite sufficient to account for the symptoms. The cause of these ulcerations would be difficult to trace, but the effect of such, acting as an irritant to the nervous system, and causing convulsions, is, in my opinion, a highly probable circumstance.

DANISH EXPLORATION IN GREENLAND.

Lieutenant Jensen, of the Danish Navy, left Denmark for Greenland, last month, on another surveying expedition, accompanied by Lieutenant Hammer, also of the Danish Navy. Lieut. Jensen will return to Europe in the Autumn, but Lieut. Hammer is directed to remain at Jacobshaven for the winter, in order to investigate the remarkable ice-fiord near that place. Dr. Steenstrup, who left Copenhagen, in 1878, on a scientific expedition in Greenland, remained at Umenak last winter, and is expected home in the Autumn of this year.

EXPEDITION TO THE CONGO.

The Rev. T. J. Camber, of the Baptist Missions, left England for the Congo, April 26. Ascending the river as far as the foot of the Yellala Falls, he will proceed by land over his old track to Makuta, and thence strike for "Stanley Pool" above the falls. A small steamer in sections, will follow by the same route for use on the waters of the Middle Congo, should his mission be successful. The Royal Geographical Society has supplied Mr. Camber with a fair outfit of astronomical and meteorological instruments.

Dr. Stewart's paper is illustrated by a map, and contains much valuable data. He reports that steam navigation already exists by the "Lady Nyassa" on the lower Zambesi, and by the "Ilala" on Lake Nyassa. The latter vessel will

probably be replaced shortly, by one still larger. There is only one broken link in the chain of communication now between the London docks and the Rombashe—that is, the seventy miles of the Murchison Cataracts on the Shire.

The "Journal" of the Royal Geographical Society for May, contains leading articles as "The second circumnavigation of Lake Nyassa," by Dr. Stewart; "Journey along part of the western side of Lake Nyassa in 1878," by the Rev. Dr. Laws, and "Notes on the physical geography of Zulu land and its borders," by Rev. George Blencowe.

By the steam packets of the Union Company, or the British India Company, it is possible to sail now from this country to Zanzibar or Quilimane, and thence, by the two small vessels already mentioned, to the north end of Lake Nyassa. Two years ago, the journey on the river and lake had to be made by canoes.

In the discussion in Dr. Law's paper, the statement was made on the authority of the agent of the Church Missionary Society, that no death had yet occurred in eastern Central Africa from *fever*, they had all been from dysentery, and the suggestion was thrown out for African travelers that the one staple of diet should be rice.

CORRESPONDENCE.

SCIENCE LETTER FROM PARIS.

PARIS, FRANCE, April 12, 1879.

For the safety of many towns and villages, and for the protection of many laborious populations, the planting trees on the mountains, to counteract torrents, has become a necessity in certain parts of France. The idea appears to be exploded that the felling of forests has no influence on inundations. Planting trees, following climate and altitude, and inducing grass to grow, are the measures adopted by the French government, and are in a sense compulsory or optional for proprietors. The aim is to anticipate the formation of destructiveness by consolidating the soil, and suppressing the effects of torrents, by extinguishing them—that is, drying them up. It is not intended actually to abolish the torrent, but to cause it to pass into the volume of a stream, to prevent its carrying down earthy matter, and producing certain floods. By protecting the soil against the mechanical effects of rain, by regulating the currents, by dividing them, inundations can be avoided. In planting trees, the object desired is to obtain a forest,

not a wood; here time is necessary and necessitates a certain movement of surface soil, of humus. For the temperate zones of mountains, the trees to be selected can afford no difficulty, but for Alpine regions, only spruce, larch and fir can be chosen—and larch above all, as it admirably resists atmospheric influences, requires no support, adapts itself to all soils, and has the faculty of throwing out new branches from old bark. Except in elevated regions, where the tree must be fir, and planted, it is an open question whether the plan of sowing or planting ought to be preferred. In any case where the latter is adopted, the trees cannot be too young. In laying down to grass, the idea must not be assumed of forming a perfect meadow, but of sowing wherever practicable, and of taking care in those districts where the pasture cannot be mown but fed down, not to allow the sheep to enter on the soil too early in summer, nor to remain too long in autumn.

M. Vogt draws attention to the fact, that migrations, whether active or passive, constitute a general and unexceptional law, as much for mammiferous animals and reptiles, as for birds and fishes, only the conditions are slower in one case than in another. It is in their young stage that sedentary animals, and those fixed to the soil, or attached as parasites to the bodies of other animals, migrate; it is thus the young coral and sponge swim; in parasites, on the contrary, the female and male insects migrate, while the young and the larvae remain where the egg has been deposited. Between locomotion and migration there is only the difference of space to depart and return from two fixed points; a snail would require ages to traverse the distance that a pigeon accomplishes in a few minutes. To change place then, an individual or species will require a period of time proportionate to its ability to move; generations supplement the brevity of single life, and time does not count in science. In the case of a new garden, insects will arrive there before snails. In Europe there has been a slow migration of mammiferæ, birds and reptiles, from south to north, as well as from east to west. It is since 1827, when the great Russian rat crossed the Volga, that it has destroyed the indigenous species, and is in a fair way to do the same in America. Wolves have invaded Europe, as hyenas and jackals Africa, as a consequence of wars and great calamities. The pretended instinct of the migration of birds is due to the stimulus of hunger. The birds make their nests where they find food for their young; hence they come northward because southern climates are too dry for insects during the summer. Similar migrations take place in the sea. In the neighborhood of the poles these are particularly notorious, the animals following the movements of the ice; seals, great whales, white bears, the musk buffalo, advance northward in summer and southward in winter, following the caprices of the ice and the accumulation of the snow. It is by this migration that animals become indigenous in a country where at first they were simply travelers, and next pioneers. To seek food is the grand stimulus of change. Inaccessible mountains, wide and deep rivers, deserts, etc., may retard migrations, in some instances obstruct them. Thus, on the other side of the Amazon, there is a different race of monkeys. Wolves have been extirpated

in England since two centuries, and the Straits of Dover impede those from the continent to cross over. Indian tigers can swim across the arm of the sea which separates Singapore from the mainland. Certain animals migrate not only to seek food, water, a more temperate climate, but also to satisfy the wants of reproduction. The latter is the motive that impels cod, herrings, tunny salmon, etc., toward "banks" in such vast shoals as to displace for miles the animals peculiar to the locality. Forget not that the migrations which take place before our eyes to-day, are the consequence of the same laws that have produced those in past ages, and as revealed by geology.

Instinct, for Descartes and many others, was simply a gift bestowed by nature at the moment of an animal's birth. According to science, instinct is merely an hereditary habitude. Thus, migration is the habitude, as with birds, for example, to search food. The stock comes southward in winter, because the aquatic food on which it lives, is inaccessible by the ice. No migratory bird ever selects an unknown path; it remembers ever the road it will have to retake, for physiologists demonstrate, birds have a marvelous power of perception; no matter how distant a bird may be from a forest, or how dense may be the latter, it knows the hollow tree wherein is its nest. In time of migration the cloud of birds is ever led by the oldest, and it is no less true, that those birds which stray from the main body and are taken are always the young—the ninnies.

Scientists are intensely occupied with the electric light; new systems are constantly being made known, or old ones improved. M. Janin, professor at the Sorbonne, has described an ingenious system. The principle of the electric light resides in the formation of a "voltaic arc," between two charcoal conductors, placed at a suitable distance; the ends of these two sticks of carbon burn and become incandescent; between them is a band of fire, less brilliant when the current is intense, than the sticks themselves; this band is composed of particles of matter of an extreme tenuity, through which also a current passes, circulating between the positive and negative poles. Magnets have an important influence on these currents, attracting and repelling. Now M. Janin employs the carbon sticks to cause the voltaic arc to blaze upwards like a flame of gas in giving them the properties of magnets, by alternately repelling and attracting the current. The carbons, further, never can be extinguished. Master of directing the arc, M. Janin, had to seek how to make it more brilliant; this he has effected by applying the means for imparting brilliancy in the case of the Drummond light, employing a morsel of chalk or magnesia. M. Janin uses a piece of chalk in the form of a hat, the jet entering beneath; the arc is thus crushed, as it were, and expends less power than if the hat were not there. More important still, the light, instead of being radiated toward the sky, and largely wasted, as in the Jablochkoff plan, is reflected on the ground—the lamp can thus be greatly elevated. The Janin light has not that sepulchral hue, so peculiar to electricity, the latter having too many violet rays, and so will be in favor with the ladies. In

a word, the system lies in the chalk, kept in a state of incandescence by the voltaic arc.

Electricity has also been applied to the unwinding of silk from cocoons. A workman must be very skillful to find on ordinary occasions the end of the thread when broken; by the new invention, the thread passes between two metal plates, and separates them. When the thread breaks the plates come together, a current is generated which communicates with a spring, and thus instantaneously stops the machinery.

Beans in Italy are attacked by a curious insect called *bruche*; on an average there are two insects for each bean—one half of the crop being affected. There is this peculiarity, the germination of the bean is never affected by the malady, the enemy not touching the germ.

The Sirocco is the warmest of winds, and is felt severely in northern Africa, and also in Sicily and southern Italy. Its coming can be predicted by the reddish orange tinge of the atmosphere, indicative of atmospheric dust. The rain clears the atmosphere of every kind of dust, hence why the astronemers select the period after rain as most favorable for their observations. Professor Ricco, of Naples, has examined the sand of the Sirocco, which comes from the deserts of Africa, and he finds it rich in the well-known and peculiar spherical atoms of iron. Where did the iron come from—or where does it originate, as it is found everywhere, possessing the same characteristics? These spherical atoms, the same that fall when flint and steel are struck, are to be found in the most ancient rocks; sea sand contains them in vast quantities; they are present in snow, in glaciers, in geological sediments; an anchor taken from the bottom of the sea wil be found eaten by rust. Now these atoms are never rusty. Science has no certain explanation to give as to their origin or their formation.

In 1878 croup and diphtheria attacked the inhabitants of Marseilles like a plague. At the same time it was observed that barn-door fowls were similarly affected. M. Nicati inoculated healthy fowls and rabbits with the disease, and the subjects of the experiment duly sank under the malady. These facts are in connection with the important problem of fermentations, which are the grand source of ruin and death. They engender disease, kill the living being, and disorganize animal and vegetable tissue. Fermentations are produced from animalcules; these microscpic creatures penetrate our tissues, absorb our blood—devour us. After death they effect our decomposition, We want to discover a substance that will kill these enemies without injuring ourselves. M. de Cyre maintains that we have found such an agent in pure borate of soda, that sold in commerce is adulterated with lead, alum or carbonate of soda. It is an inoffensive salt, destroys the germs of maladies, and is strongly anti-putrid. Small quantities of the salt in powder preserves meat, butter and milk from alteration, and without changing their appearance or altering their taste. Professor Panum, of Copenhagen, recom-

mends the use of the borate in place of ice as an agent of conservation. He has fed dogs during twenty-four days on meat preserved by the salt, the food remained fresh-looking and highly nutritive, the dogs becoming markedly fat.

Many believe that the horse is of Oriental origin and accompanied the Aryan immigrations Europewards from Central Asia—the accepted birth place of the human race. The ox has played an important part as a civilizing influence, as also the sheep, in transforming man from a hunter to a shepherd, and next, to a laborer. But it is to the marvelous organization of the horse as a motive power —it is by his strength we measure the force of steam engines, that man has been able to become an *industriel.* Professer Ecker, of Germany, maintains that the horse exists and has ever existed in a savage state, in Europe, not as in the pampas of South America, where the wild horses are the descendants of imported ancestors. The horse is not only the most remarkable but the most ancient of domestic animals, its remains having been found associated with pre-historic man. But the horse was then hunted as game, its head and bones as found with those of reindeers in caves, were selected to extract the brain and the marrow, as the Esquimaux practice at the present day. The tail was employed for its hair, but the remainder of the carcass was abandoned. The wild horse of the quaternary period has been domesticated, as the wild boar has become a pig. The remains of the pre-historic horse of Solutrĕ, in the Lyons Museum, corresponds in resemblance with the wild horses of Westphalia, Bavaria, and Russia of the present day, small, stumpy, and large headed. Later the Asiatic horse arrived by the Mediterranean, and his larger form altered the native races.

Messrs. Cumenge and Fuchs have found that in some quartz where the gold cannot be extracted by amalgamation, the cause is due to the presence of antimony, just as silver is united frequently with arsenic.

A manufacturer in the environs of Paris refines large quantities of petroleum. He observed that his workmen were peculiarly healthy and robust, in being exempted from catarrhs and consumptions, while the contrary was the case in other factories. The poor flocked to receive a daily dose—spoonful of petroleum daily, more produces diarrhœa, and were relieved of coughs and colds till the apothecaries interfered and compelled the philanthropist to cease illegally curing. The remedy is still preserved, as the faculty now prescribe petroleum in the form of capsules.

The grey oil cloth used in lining perambulators has been condemned; the varnish contains a great deal of arsenic, and when it chips babies eat it and die of convulsions.

M. Dieulefait's experiments establish that lithia is as plentiful in rocks and waters as potash and soda, and M. Bonnier concludes that many plants have nectaries wherein no nectar is secreted at all.

MEDICINE AND HYGIENE.

HOW TO PREPARE FOR SUMMER.

With the return of spring and warmer weather, it is not too early to direct attention to the various disinfectants in common use. It should be remembered that the first action of the summer in our temperate climate is not to be considered at all in proportion to the actual heat developed. There is a peculiar chemical action in the sun rays, which, most especially in the spring, appears to engender rapid decomposition. No matter how thoroughly a house is constructed, indifferent as to the skill of the plumber, necessary precaution should be exercised. Automatic traps, no matter how ingeniously contrived, will lose their self-regulating powers, and as they are concealed, no one can ever tell at what moment they may really be doing more harm than good in the house. Just as soon as cold weather is over, a careful housekeeper should examine the condition of the cellar. If there be leaks or admission of moisture in the cellar, it is more likely to be visible, now that the furnace is no longer in operation, than during the winter. It is as well to look carefully at the exact places where the drain-pipes from the closets enter the cellar. In some cases these may be built into the wall and are not visible. Good architects, with sound sanitary views, hold in horror any contrivances having to do with the health of the inmates where there is no chance of seeing or knowing whether deleterious gases are being filtered through the house or not. Many a sad accident occurs in a house where the fault is sought below the ground, when it actually exists mid-way. All typhoid fever does not exist in badly drained neighborhoods. Its sporadic character may often be traced in good neighborhoods, in carefully constructed houses, from the careless indifference of housekeepers, who will not keep their eyes about them. Cellars should be well cleaned by the end of this month. An accumulation of ashes may hide or keep in abeyance a mass of corruption, caused by servants, which becomes a source of malaria when warmer weather sets in.

One great source of health in a house is the free use of water, wherever it is found. Flushing a room wherever there is a wash-basin, even if it be an untenanted chamber, should never be neglected. If all the rest of the stationary wash-basins or sinks in the house are in use, this is all the more a reason why the one not in use should be the most dangerous one in the whole house. It is perfectly easy to understand that exactly there the mephitic gases will be formed and escape, because there is no waste to absorb them. Plumbers will tell you. and wisely that a current of hot water, from time to time, should be sent, even in warm weather, through all the basins in a house. The reason is simple.

Quite solid deposits made of soap or animal grease coat the pipes, which are only dispersed by hot water. A kitchen sink, though much hot water be passed through it, always wants, because it receives more grease and vegetable matter, both in winter and summer, some disinfectants. The simplest, and one which can be used at the lowest cost, is to dissolve the common sulphate of iron of commerce in water, a pound to a bucket of water, and use in all those parts of the house where water is turned on. The action of the sulphate of iron is purely a chemical one without antiseptic properties. All it does is to deoxidize the decomposing substances. Nitrate of lead, more expensive, is also a very safe disinfectant. The permanganate of potash acts even more rapidly than the salts of iron or lead. Of late years the use of carbolic acid as a disinfectant has not been so much in vogue. Its influence seems to be more local, acting rather on the atmosphere than the source from which the decomposition arises.

It may be taken as a rule that, in attempting to purify a house, it is of little use to attack the atmosphere. The vitiated air, though breathed and containing the poison and the germs of disease, renews itself over and over again, faster, perhaps, than it can be corrected. A saucer of chloride of lime in a room may destroy the poisonous gases. But it is the source itself which must be sought and corrected. Strike at that, purify that by destroying the cause, and the effects must pass away in time. The use of iodides and bromides in a house is accompanied by so many drawbacks as not to be recommended. Some old methods, as used on board of ships, are excellent. A room in which a fever patient has been confined, may be rendered salubrious, and the germs of all disease killed, by burning sulphur in the room, at first having, of course, removed all the furniture, otherwise it would become rotten and bleached. There ought not to be, even with a defective sink, a bad atmosphere in the house, providing the sources of such disturbance be properly watched. Two or three dollars' worth of sulphate of iron, or twice that amount if expended in nitrate of lead, used a little every day during the summer, must tend to kill the germs of disease.

The ventilation of a house from the cellar is thought by some who have carefully studied the subject to be unwholesome. The argument is that since the cellar is nearer to the dangerous ground, we take this vitiated air and allow it to permeate the house. It would be impossible in ninety cases in the hundred to isolate the cellar from the rest of the house, though it is attempted in some cases. The only true method is to keep the cellar perfectly clean in summer, and to watch carefully all pipes and drains leading into it. It is there mostly that the hygiene of the house is to be attended to, for no amount of precaution above will prevent the danger which exists below.—*New York Times.*

OZONE IN RELATION TO HEALTH.

Ozone is a most powerful oxidizing disinfectant, and it is so in virtue of possessing the power of resolving and decomposing all animal and vegetable putrescent matter into primitive and innocuous forms. A stream of ozone passed through a mass of black, offensive and putrescent blood, effects a change in it as if by magic; immediately, almost as soon as the operation has commenced, all disagreeable odor is removed, it resumes its florid red color, and coagulation is restored. The products of putrefaction are, as no doubt you are aware, not only favorable to the development of special poison germs, but such products also, by their continued action, prevent the proper oxidation which should go forward in the various tissues of the body, thus causing a predisposition to the action of any poisoned germs to which the body may be exposed. If ozone be diffused through apartments or elsewhere, it not only disinfects, by removing noxious vapors and poison germs, whatever their character may be, but, being itself in the gaseous form, it is inhaled during respiration, and, passing into the blood through the lungs, it oxidizes the used-up and effete matters produced during assimilation and the renewal of the various tissues, thus effecting in no inconsiderable manner a certain resistance to their pernicious influence if retained within the human body.

There has been much discussion as to what the precise nature of disease germs may be; but be they in the form of bacteria, or of any other form, ozone is potent for their destruction. . . . There are other competing disinfectants, such as iodine, chlorine, bromine, etc., but it has always appeared to me that we have in ozone Nature's own provided disinfectant; and, although I admit that artificial states often require the application of means correspondingly artificial, yet, by keeping on Nature's lines, using the very means she herself makes use of for the maintenance of life, the continuance of health, and for rendering innocuous the products of the functions of life, we are more likely to effectually attain the object in view than by making use of any other means whatever. The always and everywhere present oxygen needs no expensive process for its production, while its conversion into its most active condition, in the shape of ozone, may be arrived at by means so simple and so inexpensive that, on these grounds, if on no other, it stands, at least in my estimation, as the best, the safest, and least objectionable of all disinfectants. Lastly, ozone admits of being administered as a remedy for disease, and is, indeed, so administered in the form of ozonized oil, ozonized ether, and ozonized water. Here it ranks with remedies containing chlorine, bromine, and iodine. Whether in any respect it may, as a remedy, prove to have greater advantages than any, or all, of these agents, must be arrived at by determining whether it will do what the others cannot do. This, of course, can only be clearly and decisively made out by applying to it the test of an inductive philosophy—a rigid exclusion of all that is ineffective.—*Sanitarian.*

A NEW ANTISEPTIC.

A new antiseptic agent has appeared in Germany, which, if the statements regarding it are true, is one of the most important yet discovered. It is a double salt of borate of potassium and sodium, and is made by dissolving in water equal quantities of chloride of potassium, nitrate of sodium, and boracic acid, and evaporate to dryness after filtering. Its cost is about 25c a pound, and its use in foods, etc., does not in the least injuriously affect them, and gives no taste or smell to substances. It has been extensively employed already by butchers, saussage makers, tanners, etc.; but its most important use at present is in the manufacture of butter and cheese from sweet milk. When butter is made from sweet milk in the ordinary manner, the milk must be kept very cold; when the "preserving salt," as it is called in Germany, is used, the milk may be kept at ordinary temperature without souring; the remaining milk may be worked up into a superior quality of cheese. If fifteen grains of the salt are added for each quart of milk, the latter will keep sweet for at least a week. Fresh meat, game, etc., may be preserved by dipping it into a solution of one pound of the salt in six pints of water. When the meat is intended to be kept for a long period, it is rubbed in well with the powdered salt in the proportion of one and one-half drachms to each two pounds of meat. In twenty-four hours the impregnation is completed, and it only needs to be dried. A piece of meat prepared in this manner in January, 1877, was in perfectly good condition in January, 1879. For pickling, the meat is prepared in the same manner, and then placed between two layers of a mixture of two pounds of common salt, one-half pound preserving salt, and one-fourth pound of sugar. In this way the largest hams can be salted in four days. For preserving skins, from one-half to two pounds are used, according to size. Eggs are placed for fifteen minutes in a solution of one ounce of the salt in a quart of water. To preserve beer, wine, etc., it is sufficient to rinse the bottles, previous to filling them, with a solution of the salt in the proportion of one to ten, and adding to the beverage itself eight grains per quart. For fish, lobsters, oysters, fruit and vegetables, the preparation has also been use with the best success.—*Boston Journal of Chemistry.*

PETROLEUM IN AFFECTIONS OF THE CHEST.

Dr. Blache states, in the *Bulletin de Therapeutique*, that a refiner of petroleum having been prohibited by a préfet, at the request of some *pharmaciens*, the distribution of petroleum in medicinal doses, this led to an inquiry being made as to its alleged utility in affections of the chest. The native petroleum from Pennsylvania and Virginia was that experimented upon first. It is a very safe substance, for even large quantities, when drunk by error, have caused only a little nausea. In chronic bronchitis, with abundant expectoration, it rapidly diminishes the amount of the secretion and the paroxisms of coughing, and in simple bronchitis

rapid amelioration has been obtained. Its employment in phthisis has been continued for two short a time as yet to allow of any opinion being delivered as to its efficacy, beyond that it diminishes the expectoration, which also loses its purulent character. The petroleum is popularly taken in doses of a teaspoonful before each meal, and, after the first day, any nausea which it may excite in some persons disappears. M. Gardy, a Paris *pharmacien*, has prepared capsules, each containing twenty-five centigrammes of petroleum, or, as he calls it, *huile de Gabion*, from the name of an ancient petroleum spring, and this Dr. Blache considers as the most favorable mode of administering it.

CURRENTS OF AIR AS AFFECTING HEARING.

Jacques has studied the effect produced by the motion of the air in an auditorium upon its acoustic qualities, using for his purpose the Baltimore Academy of Music. Having proved by direct experiment that variations in density in the air transmitting sound not only decrease materially the intensity of the sound, as Tyndall has experimentally shown, but also actually modifies its form, and thus give rise to confusion and indistinctness, it naturally followed that in public halls where such currents of air really exist in abundance there must be much difficulty from this cause. In the building above referred to, the whole supply of fresh air is admitted at the back of the stage, is there warmed, then crosses the stage horizontally, passes through the proscenium, and diagonally upward toward the roof, across the auditorium, in one large current, and goes out partly through the roof and partly through the registries in the gallery ceilings, into a ventilating tower over the chandelier, whose heat is the motive power. About 15,000 cubic feet of air per minute are thus drawn through the house. The acoustic qualities of the house, being exceptionally perfect, are ascribed largely to the condition of the air within it. To test the question, experiments were made by stationing persons in various parts of it during a performance, and asking them simply to note the comparative ease with which the performers could be heard. At various intervals the valves controlling the circulation of air were reversed, so as to produce currents. Almost invariably the testimony was that at times, which proved on comparison to agree with those at which the reversals had taken place, the sound was confused and indistinct, and people all over the house were seen to make an effort as if to listen.—*Editor's Scientific Record, in Harper's Magazine for June.*

PAIN AND THE WEATHER.

In his paper on the Relation of neuralgic pain to Storms and the earth's magnetism, read before the National Academy of Sciences, Prof. S. Weir Mitchell reported the following observations:

Captain Catlin, U. S. Army, lost a leg during the war, and since that time

has suffered from traumatic neuralgia, sometimes in the heel, but more frequently in the toes, of the foot. He has carefully noted the effects produced on himself by changes of the weather. Dr. Mitchell's own studies in this case, as he says, "would never have proved successful had it not been for the unusual ability, interest in the task, and perseverance of the accomplished gentleman who has obliged me by making his own tortments useful in the solution of the question of how far weather effects the production of certain kinds of pain." The hourly observations cover a period of five years. "For the first quarters of these five years there were 2,471 hours of pain; for the second quarters, 2,102 hours; for the third quarters, 2,056 hours, and for the last quarters, 2,221 hours. The best yield of pain is in January, February and March, and the poorest in the third quarters, July, August and September. During these five years, while the sun was south of the equator, there were 4,692 hours of pain, against 4,158 hours while it was north of the equator; and the greatest amount of pain was in the quarters beginning with the winter solstice, and the least was in those beginning with the summer solstice. The average duration of the attacks for the first quarters was 22 hours, and for the third quarters only 17.9 hours.

By taking the four years ending January 1, 1879, it is found that of the 537 storms charted by the Signal Bureau, 298 belong to the two winter quarters, against 239 for the summer quarters. Hence we have the ratio of the number of storms of the winter quarters and summer quarters corresponding to the ratio of the amounts of neuralgia for these respective periods, and the ratio of average duration of each attack for the same time corresponds closely with the ratio of the respective total amounts of neuralgia for the same periods The average distance of the storm center at the beginning of the neuralgia attacks was 680 miles. Storms coming from the Pacific coast are felt farthest off, "very soon after, or as they are crossing the Rocky Mountains," while storms along the Atlantic coast are associated with milder forms of neuralgia, and are not felt until the storm center is nearer. Rain is not essential in the production of neuralgia.

It was found that the severest neuralgic attacks of the year were those accompanying the first snows of November and December. One of the most interesting and valuable results of this series of observations is thus stated: "Every storm, as it sweeps across the continent, consists of a vast rain area, at the center of which is a moving space of greatest barometric depression, known as the storm center, along which the storm moves like a bead on a thread. The rain usually precedes this by 550 to 600 miles, but before and around the rain lies a belt which may be called the neuralgic margin of the storm, and which precedes the rain about 150 miles. This fact is very deceptive, because the sufferer may be on the far edge of the storm basin of barometric depression, and see nothing of the rain, yet have pain due to the storm.

SCIENTIFIC MISCELLANY.

THE CERAMIC ART OF JAPAN.

W. E. GRIFFIS.

The first historic notice of the ceramic art in Japan is that of the terra-cotta figures set in the earth in a circle round the dead, in place of the living victims formerly buried up to their necks. After death by starvation, a circle of skulls marked the site of the illustrious dead, like the cairns of Britain. Ancient graves, occasionally opened in the vicinity of Nara and Kiōto, are found surrounded by a circle of clay images. At the death of the wife of one of the ancient mikados, who had been grieved at hearing the groans of the dying victims buried alive to their necks with the dead Prince Yamato hiko no mikoto, he permitted his adviser to bring a hundred workmen in clay from Idzumo, who made clay images of men, horses, and other things, which were buried in lieu of men with the empress. Potters, brick and tile makers, came over from Corea with other artificers in the seventh century, and in A. D. 724 progress in the ceramic art began by the introduction of the potter's wheel, and continued for five centuries in the working of faience only, pure Japanese porcelain being unknown till the time of Hidéyoshi. In the days of the Hōjō Kato, Shirozaēmon having visited China to study the art, came back and erected his wheels and kilns in Séto, Owari, making, however, only pottery of an improved sort. "Séto-mono" (Séto ware, or séto, like our term "china") is the common name for household crockery in Japan. The making of real porcelain in Japan was begun by the Corean potters brought into Japan by the Japanese who invaded Corea (1592–1597). These captives were settled in Buzen, Higo, Hizen, Ozumi, and Satsuma, in Kiushu, where are still the oldest seats of the ceramic industries, and at Yamaguchi, in Nagato, and near Kiōto. About the same time a Japanese from Isé, who had studied the clays, pigments, and methods of the Chinese, settled in Hizen, where he found beds of clay of the varied qualities necessary to produce the famous Hizen wares. It is only in very recent times that the potteries of Owari, Mino, and Kaga have become celebrated; and those near Tōkiō and Yokohama only within the last decade At present it is notorious that the "old" Satsuma. Hizen, and Kiōto wares are imitated in scores of kilns all over the country. Very few pieces of the highest artistic merit have been produced since the Restoration, as the making of porcelain and faience in Japan has since 1868 degenerated from an art to a trade. In the days of feudalism, masterpieces of the ceramic art were made for princes and lords, for presentation to fellow-daimiōs, the shōgun and court nobles. Such things were not bought and sold. There were, properly speaking, no shops for

their sale. Only household crockery was seen in the shops. Fine pieces were not in the trade, a fact which explains what foreigners have so often wondered at, namely, that until eight or ten years ago, the rarest porcelain was made in Japan, and occasionally found its way to Europe, yet the keenest-eyed visitor never saw it on sale. Formerly the artisan was an artist, and worked for low wages and honor. He lived on a few bronze cash per day, yet enjoyed the presence and friendship of his lord. The daimiō visited the potter at his wheel, and the potter sat in honor before his master on the mats of his palace—a place in which the richest trader in the province could not so much as enter. To imprint his stamp, or to scratch with his little finger-nail his name or mark on the bottom of a tea-bowl, or "clove-boiler," or vase over which he had spent a year or three years, and which should adorn for generations the *tokonoma*, or nooks of a daimiō's chamber, was sufficient reward to the workman already proudly happy in his own work. Of this contented happiness in work which found its reward in honor, not gain, I was more than once a witness. It is to be hoped that the government and native art-lovers, and the proper foreign influence, will be able to arrest the downward tendency of Japanese art in ceramics, and restore it to its former glory, even though the social atmosphere and environment are now so wholly changed.

The villages in which faience and porcelain are made, whose names are household words in America and Europe, look like any other Japanese villages. In the dingy, weather-beaten cottages, made of wood, mud, reed, and thatch, the potters work before their paper windows, the force in each "establishment" usually consisting of father and son, rarely of more than three or four men. The kiln or kilns are the common property of a village, built up the sides of a hill, and fired with pine wood, the workmen taking turns in noting the temperature and watching the melting of sample enamels on bits of clay set near the plug-holes.

Often the biscuit is made in one place, and the glazing done at another. Many potters now sell their baked wares to artists in Tōkiō and the large cities, who lay on the colors, decorate, and fire in their own furnaces—a process I have often watched in Tōkiō. New designs are wrought by the artist from a drawing, but stock subjects are laid on from memory, and for the cheaper wares dabbed on. In the potteries the principle of division of labor is well understood, one man making bodies, another spouts, another handles or ears, his specialty. Of late years companies employing capital have centralized labor, and collected workmen in large establishments, improving their fortunes, and, in rare cases, improving the art.

Japanese porcelain or faience takes its name from the name of the trading town, the place of manufacture, the port whence it is shipped, the name of the province, or the place where it is decorated. The following ware is the most celebrated:

SATSUMA.—The oldest specimens have no colored decoration, and date from about 1624, those of the latter part of the century being but slightly adorned in

colors. From the beginning of the eighteenth century appear figures, landscapes, and the general style of decoration in gold and bright tints called *nishiki* (flowered silk, or brocade). The rich gilding, the harmony of colors, and the delicacy of drawing, have united to give "old Satsuma" which is mostly in small pieces, its renown. Most of it is crackle, called *hibiki* (snake porcelain), the cracks imitating a serpent's skin. The body of nearly all fine Satsuma ware is white, or cream, or buff color, though red, green, chocolate, purple, blue, white, and black glazes, made of native minerals and metallic oxides, are used. All sorts, qualities and colors are now made and exported from Satsuma. Nearly all Satsuma ware is faience, semi-porcelain, or stone-ware—not true porcelain.—*The Mikado's Empire.*

PROGRESS OF ELECTRIC LIGHTING.

While the sensational reports in regard to electric illumination have subsided, the electric light is making friends in various quarters. The Waltham Bleachery, Mass., have been using two generators of the Wallace-Farmer pattern. Ten lights supply 112 four-foot gas burners. The generators require twelve horse power apiece, and the horse is estimated at one cent per horse power per hour. It is stated that the quality of the light is good; no complaint is made of its flickering. Washburn & Moen of Worcester, Mass., use the Brush electric light to a limited extent, lighting but a portion of their works. They state that they get much more light from gas for an equal expenditure of money. No accurate experiments, however, have been made.

The Riverside Mills, of Providence, R. I, employ two Brush generators. One machine has been running about two months in a weaving room, and part of the rest of the mill has also been lighted with electricity. These mills runs night and day, and use a large number of gas burners from 10 to 12 hours per day, and, therefore, are peculiarly well fitted for the employment of the new light. Twenty electric lamps have taken the place of 230 five foot burners in a weaving room, and give a better and more satisfactory light The work requires an unusually strong illumination.

The lighting of the Boston Music Hall by electricity has been postponed until a larger machine of the Brush pattern can be completed. In the preliminary trials it was found that the light would be unpleasant to a general audience, and it is, therefore, proposed to modify its color and brightness by the employment of suitable glass or porcelain shades.

W. Mattieu Williams, F. R. A. S., in a recent paper gives an interesting resumé of early English experiments on incandescence, particularly those of Mr. Starr. The latter devised a peculiar method of winding the conductors of a dynamo-electric machine. Since the thick copper wire, usually made use of, necessarily is wound on the armatures in a spiral, there is a certain loss of compactness, and an increase in resistance, which Mr. Starr proposes to obviate by

using a core of square section, and winding around it broad ribbons of sheet copper, which was insulated by cementing on its surfaces a layer of silk ribbon. This ribbon is to be laid with one edge against one side of the core and carried on until the angle, then it is to be turned over so that its opposite edge may be laid along the next side of the core, and so on. It seems as if this method of winding dynamo-electric machines would have certain obvious advantages. The experiments of Starr, however, on lighting by incandescence did not result in much successs, and they were unfortunately brought to an end by the untimely death of the inventor. Prof. Williams, who has devoted much attention to the manufacture of gas, believes that there is a greater field for invention in gas manufacture than in the field of electric illumination. The by-products, ammoniacal salts, liquid hydrocarbons, and coke, are sufficient, in his opinion, to cover the whole cost of manufacture of gas, and leave gas itself as a volatile residuum that costs nothing. He thinks that gas might be delivered to consumers in London at one shilling per thousand cubic feet "if gas making were conducted on sound commercial principles—that is if it were not a corperate monopoly, and were subject to the wholesome stimulating influence of free competition and private enterprise" He, therefore, thinks that any comparison of the two methods of illumination based upon the present cost of gas is essentially misleading, for future invention can materially reduce the price of gas.

Prof. W. E. Ayrton also takes up the subject of electric lighting by incandescence, and proves that the electromotive force necessary to be maintained at the two ends of a wire of platinum, five centimeters in length and one millimeter in diameter, and at the ends of a piece of carbon, two centimeters in length and one millimeter in diameter, is 0.2848 volt, or about one-third of a Daniell's cell in the case of the platinum, and 0.46013 volt, or about one-half that of a Daniell's cell in the case of the carbon wire. It is, therefore, possible to produce a light with an electromotive force less than that of a Daniell's cell, but not with a Daniell's cell itself, since the internal resistance of the cell is far greater than that of the incandescent wire or rod of carbon. He was enabled to use the method of incandescence in 1873, when the government was employing divers to recover the property sunk in the French mail steamer Nil, off the coast of Japan. An ordinary carbon rod was first scraped very thin, and then, with connecting wires affixed, it was placed in a vacuum globe, and by heating it with an electric current, and passing air through the globe, it was burnt to the required degree of thickness; the current was then stopped and the air pumped out and replaced by nitrogen. The agitation of the subject of electric illumination certainly will provoke inquiry into the subject of the cost of gas, and, therefore, ought to be encouraged.

THE electric light is about to be introduced into two or three London churches. It is also largely employed at Westgate-on-Sea, upon the extensive estates of an English gentleman who is interested in comparing the relative cost

and advantages of electric light and gas. Along the pretty sea-frontage of Westgate are arranged rows of electric and gas lamps, the one to illuminate the broad marine parade and drive, with the tasteful villas and terraces, and the other to light up the ornamental gardens and promenades Notwithstanding the semi-opaque globes absorbing some sixty per cent of the brilliant white electric light, the adjacent gas lamps appear in contrast to burn dimly, with a smoky, dull, dirty amber-yellow flame.—*Scientific American.*

PROPAGATING RARE PLANTS.

BY THOMAS LAWRENCE, OGDENSBURG, N. Y.

There may not be anything new in the following method of propagation; still as I never saw or heard of it before hitting on it, I thought there might be some of your readers like myself.

It is nearly always desirable to increase new plants, and plants of slow growth, faster than they furnish wood for the purpose. It can be increased from two to ten fold by commencing at the point of a well established plant, and splitting it downward an inch or more according to its nature and growth, leaving it in that condition for a day or two. Then commence at the point of these halves, and split them down into quarters. Leave them from two to ten days to callous, when each quarter will make a cutting almost certain to grow, even if cut into single eyes. As soon as the cuttings have rooted, been potted and well established, split them also half their length, and in a few days more continue the split down to, and through the roots, making two or more plants instead of one. I find it advantageous with tricolored geraniums, double primulas, etc. It does not endanger the life of the parent plant, for they can be taken off a few at a time, thereby lessening the shock that would occur to some plants if the whole top were taken at a sweep. The parent plant goes right on growing without the necessity for repotting. The young growth of most hard wooded plants might be facilitated in the same way. There is no rotting in the cutting bench as is often the case with whole cuttings of tricolor geraniums, poinsettas, etc.—*Gardener's Monthly.*

THE CELEBRATED "CARBONATES" OF LEADVILLE.

The ore found here is carbonate of lead, carrying silver. The only form in which the silver is recognizable is that of chloride of silver, which is sometimes seen as a thin layer of yellow wax-like substance on the surface of the hard carbonate ore. Generally the silver is so intimately associated with the lead that it is impossible to determine its form. In the furnace equal parts of charcoal and coke are used for fuel, and iron ore and limestone, and sometimes the slag from the smelter, are used for flux. At the smelting heat the oxide of lead, which is an extremely unstable compound, surrenders its atom of oxygen, which unites

with the carbonic oxide, and forms carbonic àcid, setting the lead free. The chemical process with the silver is not known, except when it is in the form of a chloride, in which case the chlorine is volatilized. The silver and lead, being heavier than the substances held by the flux, then sink into a well at the bottom of the furnace, from which they are ladled into molds that hold about 100 pounds of the base bullion, while the slag floating on top is drawn off through a higher channel into heavy conical coolers, and emptied in sugarloaf cones on the dump. The carbonates are hard and soft, the hard varying in color from that of gray limestone to dark slate, and the soft from a deep cream to a rich dark brown. The hard is a dense, firm rock of great hardness, requiring powder to remove it; the soft is sometimes of the consistency of chalk, that can be crushed with the fingers, or in the form of a coarse sand, and can be mined with pick and shovel. The presence of masses of galena in the vein is not infrequent, and in such relation to the carbonates as to lead to the belief with some that the carbonates are the result of a change from sulphurets to carbonates by the action of water or air.—*Cor. Globe Democrat.*

LEATHER PAPER.

The *Leather Trades Circular* says: The idea of utilizing scrapings and other leather waste has always been a favorite one with inventors; and so far back as 1786, Mr. Samuel Hooper obtained a patent for the manufacture from leather or leather cuttings, or parings, of a material for covering carriages, trunks, etc., and for making hat and band boxes, tea-trays, etc., and also in the manufacture of different kinds of paper from leather. For making the new material, the leather was washed clean, and then worked with a proper quantity of water till it was reduced to a pulp. When necessary, size was used. The pulp was next placed in molds and exposed to a pressure necessary to give it a smooth and even surface. It was also passed between iron and brass rollers. For making hat and band boxes, the process was the same, except that when the leather was reduced to a pulp it had to be freed from all water and mixed with strong size. It then attained the consistency of thick paste, and could be molded in any required form. For making paper, the leather was reduced to a pulp in the manner before described. If brown paper was wanted, a fourth part of junk or hemp, with a little fine clay, was mixed with the pulp. For whitey-brown paper, the coarsest rags were used instead of junk and clay. For white paper, three parts of fine rags and some size had to be added to the leather. The paper was manufactured from the pulp in the ordinary manner.

THE GREAT SPIRIT SPRINGS OF KANSAS.

These springs, located about three miles from Cawker, to the southeast, are great natural curiosities, and in the future will undoubtedly be a great place of resort. Approaching them from any direction you find paths pointing toward them, now nearly overgrown with grass, made by buffalo in going to them, for salt, no doubt, when this now almost extinct animal roamed so extensively and supremely over this region. The spring, which is a general term for what is actually a mound, in the top and center of which is a basin of perfectly clear water, is about the most unexpected thing to find here that can be thought of. The mound is some sixty feet in diameter, twenty feet high, and almost circular in shape, with oval top. The water from the basin does not flow over the top now, although it may have done so in the past, but comes out on the south side in a clear little basin, where the drinking water is obtained. The basin on top of the mound is said to be very deep, almost fabulous, in fact, but, I am confident, highly exaggerated. Water oozes out on the sides of the mound in a few places only. A little dry ravine comes in on either side of the mound (I must say spring), making it an island in fact, or it would be an island if there was any water in the ravine. There are many theories as to how the spring came to exist in this shape, one of which is that by continued overflow for hundreds of years, the water leaving a deposit of lime, gradually rose at the rim, and flowing over, caused the almost gradually sloping or circular sides. From my observation I am convinced that such is not the case, as the rock, of which the mound (spring) consists entirely, is in stratified form, each stratum being almost level and apparently running from side to side. The water has a brackish, salty taste, much resembling in taste that from the Iola wells. It is said to have many curative principles, and has been used here to some extent by physicians.—*Cor Kansas City Times.*

BOOK NOTICES.

ADULTERATION OF FOOD AND MEDICINE. By Edward R Squibb, M. D., Brooklyn. G. P. Putnam's Sons, New York. Kansas City Book and News Co.; 25c. Pp. 57.

This is Number XIV of the "Economic Monographs," and is an argument in favor of a bill providing for general State Legislation on this important subject, together with notes in reply to criticisms by the press. The importance of such a law is manifest, and Dr. Squibb has brought it forward in the shape of an act already prepared for presentation to the legislatures of the various States, with such explanations and illustrations as his wide experience has suggested to him. The subject deserves the prompt attention of law-makers and good citizens generally.

QUARTERLY REPORT OF THE KANSAS STATE BOARD OF AGRICULTURE. Alfred Gray, Secretary. Topeka: Geo. W. Martin. Pp. 77, octavo.

As we have had occasion several times to say, these Reports are doing more good for Kansas than any other means she could adopt to inform the people of the country and the world of the wonderful resources of that state, and Secretary Gray has shown and is showing an admirable fitness for the position he holds.

The number under notice contains chapter after chapter of the most valuable and suggestive statistics relative to industries, population, natural resources, etc , by counties, and is just what any intelligent immigrant needs in making up his mind it what portion of the state to settle down.

LEADVILLE AND TEN-MILE. Stephen F. Smart. Kansas City: Ramsey, Millett & Hudson; 50c. Pp. 56, octavo.

The above named book is by far the most comprehensive and accurate we have yet seen on this subject. Mr. Smart is a writer of unusual vigor and clearness, and has already done much, through his various writings, to direct attention to the resources of Kansas and Colorado. The present work on the Carbonate Camp of Colorado, bears evidence of more than usual care in its preparation, and is replete with accurate and highly valuable information concerning the remarkable mines at Leadville and the more recent discoveries at Ten-Mile, Eagle River, Elk Mountain and the Gunnison country. Among other important features, we notice a carefully prepared glossary of mining terms, a list of the important mines at Leadville, together with the prices at which many of them were bonded or sold; a table of the average yield per ton of the Leadville mines; a table of the important discoveries at Ten-Mile; advice to prospectors; cost of sinking shaft, and much else of great interest to persons who have an idea of going into the Carbonate Camps, or who desire to know their characteristics. The book also contains two accurate maps and a summary of the national and state mining laws, and rules of the national Land Department.

Taking it altogether, "Leadville and Ten-Mile" is the most valuable contribution to the literature of the Carbonate country which has yet appeared, and will be eagerly sought for by the thousands who have read Mr. Smart's previous works.

The book is being printed by Ramsey, Millett & Hudson, which is a sufficient guaranty of its typographical excellence.

A note just received from Prof. J. D. Dana, of New Haven, calls our attention to an error of quotation, by Mr. Edmunds, in his article in the May number of the REVIEW, page 32, where he erroneously uses the word *man* in a quotation relative to the cretaceous saurians. Prof. Dana says he "supposes he ought to laugh at it as a joke," but at the same time regards it as "not pleasant to be misrepresented even for the amusement of others."

EDITORIAL NOTES.

THE Lecture of Professor Marshall, on the 9th of May, at the Opera House, upon the National Yellowstone Park, was a most entertaining and instructive one, and was attended by a good audience. The Academy of Science has thus far been very fortunate in securing the services of eminent and popular lecturers at its public entertainments, so that hereafter there will be no difficulty in calling out full houses on such occasions.

THE Anthropological Society of Washington has recently been organized with Major J. W. Powell, as President; Elmer J. Reynolds, Recording Secretary, and Prof. Otis T. Mason, Corresponding Secretary, to whom communications may be addressed and specimens sent.

PROFESSOR RILEY, after an extended series of tests, finds that the mulberry may be entirely dispensed with, and the leaves of the osage orange, a very common hedge plant in sections where the climate is favorable to the silk worm culture, may be substituted without any danger of impairing the result.

THE *American Chemical Journal* is a new periodical edited by Professor Remsen, of the Johns Hopkins University at Baltimore, Md. It will be devoted to pure chemistry but will also contain reports by eminent chemists on particular branches of this science.

Harper's Monthly commences its 59th volume with the June number, and this beginning is signalized by a general and permanent improvement—increasing the size of the type and the width of the page, both of which changes add to the beauty of the work, while the remarkable excellence of its engravings is a feature which, in our judgment, renders it preëminent among the numerous illustrated magazines of the day.

THE success quietly attained by the *Library Table* during the past three years has induced the publishers to issue it Weekly instead of Fortnightly as heretofore. It is their purpose now to push the *Library Table* forward to its proper place among the leading journals of the country. It has been increased to 32 pages and enlarged slightly in form. Its high literary character will be maintained,—viz: its Signed Articles by leading writers on the principal books published, critical notes and comments, "Briefs" on important volumes freshly issued, and the most recent intelligence concerning the makers and making of books—and several new departments will be introduced. The enlarged size and scope of the paper will permit the discussion of important political questions. "Notes of the Week" will be bright, trenchant comments on current events. "Contributors Miscellany" will contain piquant sayings, odd conceits, poems, reminiscences. A department of Notes and Queries will be introduced, and greater space given to the departments of Music, Drama and the Fine Arts, which will hereafter be conducted by competent specialists. There will also be a weekly article on the Stock Market, and particular attention will be given to the great Financial and Industrial interests of the country.

THE Santa Fe *New Mexican* says: A specimen of the handiwork of the ancient Spanish miners inhabiting this Territory was brought to town from the Cerrillos mines a day or two since, and is now on exhibition at the office of Gen. Atkinson. It is a casting from what seems to be pure silver, and is, taking a front view, in the shape of a crown. At the base it is two and one-half inches thick, at the top two inches, and at the sides one and one-half inches. Its greatest width is six and one-half inches, and from the top to the bottom six inches. Its weight is nine pounds and fourteen ounces. If pure silver, its intrinsic value is about $150, but there is supposed to be some gold in it, which, of

course would add to its value. This remarkble ingot was discovered under a boulder about half a mile to the southeast of the celebrated Turquise mine, in the midst of the new discoveries. It must have lain there at least since 1680, as no working in these mines was done by the Spaniards after the uprising of the Indians during that year.

A DEADLY disease has broken out in the Caucasus which proves fatal in twenty-four hours. In Derby, which contains 150 houses, seventy persons died. In Medivrichevi, with 200 houses, there are 200 persons dead. The mortality elsewhere is on the same scale.

THE National Academy of Sciences has just held its annual session in Washington, with Vice-President Marsh in the chair. In his opening address he paid a feeling tribute to Professor Henry, the late President of the Academy, and reviewed the work of the Academy for the past year. Among the papers read the following have the more general interest: The Relation of Neuralgic Pain to Storms and the Earth's Magnetism (S. Weir Mitchell); Oxygen in the Sun (Henry Draper); Vowel Theories based on Experiments with the Phonograph and Phonautograph (R. G. Bell); Eclipses of Jupiter's Satellites (E. C. Pickering); Errors of Pendulum Experiments, and a Method of Swinging Pendulums, proposed by M. Faye (C. S. Peirce); Report of Progress of the International Bureau of Weights and Measures (J. E. Hilgard); and Critical Remarks on Observations alleged to be of Intramercurial Planets (C. H. Peters). Professor William B. Rogers, "the Nestor of American Geology," was elected President of the Academy, to succeed the lamented Henry, and the old officers were reëlected.

WE learn from the London *Iron Journal*, that the Missouri Lead mining and Smelting Co., under an agreement of 8th ult., proposes to purchase from the Virginia Lead Mining Co., of Franklin, in the State of Missouri (U. S. A.), and from Messrs. Nathaniel Sands, Francis Albuquerque Sands and George Hopkins, the Virginia Mine, the Piney Mine, and the St. Clair Mine, situate in the above State. The company was registered 17th ult., with a capital of £90,000, in £10 shares, of which 4500 will be A or preference shares, bearing a preferential dividend of 10 per cent.; the remaining 4500 will be styled B or ordinary shares. The purchase includes all appurtenances of the said mines. The consideration for the Virginia Mine is £60,000, payable £15,000 in cash, and the remainder in fully-paid B shares. For the sale of the Piney Mine, Mr. F. A. Sands is to receive £3000 in cash. The consideration of the St. Clair Mine is the payment to Mr. N. Sands of £2000 in cash.

MESSRS. LINDSAY & BLAKISTON, of Philadelphia, are issuing a series of 16mo. Health Primers, written by some of the most experienced and distinguished physicians of Boston, New York and Philadelphia, and edited by Dr. W. W. Keen, Fellow of the College of Physicians. The subjects, as far as announced, are: Hearing, and How to Keep It; Long Life, and How to Reach It; Sea Air and Sea Bathing; The Summer and its Diseases; Eyesight, and How to Care for It; The Throat and the Voice; The Winter and its Dangers; The Mouth and the Teeth; Our Homes; The Skin in Health and Disease; Brain Work and Overwork

THE exportation of American coal to Europe, and especially to Mediterranean ports, has greatly alarmed the English producers of coal, who have heretofore supplied those countries. More than twenty cargoes of American coal have reached the Mediterranean within the past sixteen months, and a report has now reached London that an Italian firm has ordered a supply of 100,000 tons of coal from the United States.

ONE of the best articles of the season is that of Dr. George M. Beard, in the *Atlantic* for June, upon "The Physical Future of the American People," in which he develops the central idea that Young America finds itself contending with the combined disadvantages of youth, an exhausting climate, and the heightened activity demanded by the "fast-

ness" of the age, to meet which it has been and will be found necessary to seek out and develop numberless modes of physical exercise, and reduce the philosophy of enjoyment and recreation to a science and art.

This number of the *Atlantic* closes the 43d volume, and may be classed as one of the best in its long history.

To THE pessimistic rationalists of the present day, who find nothing to admire or to hope for in this world, we commend the following lines from an old poem, by Morris, entitled the "Epic of Hades:"

"For while a youth is lost in soaring thought,
And while a maid grows sweet and beautiful,
And while a spring-tide coming lights the earth,
And while a child and while a flower is born,
And while one wrong cries for redress and finds
A soul to answer, still the world is young."

THE commencement exercises of the University of Kansas will be held June 6th to 11th. As our citizens are nearly if not quite as directly interested in this institution as in the University of our own state, and it is so easy of access, a very considerable attendance from this city might reasonably be expected.

THE endowment of the Celtic Chair at Edinburgh University is nearly completed. The sum of $59,810 has been collected, and only $190 is now required. No actual appointment to the professorship will be made before the spring of 1880. Practical instruction in Gaelic will be one of the duties of the chair as long as that language shall be a recognized medium of religious instruction in the Highlands.

DR. ISAAC HAYS, for fifty-two years editor of the *American Journal of Medical Sciences*, died April 13th. He was born in Philadelphia July 5, 1796, and was the oldest living editor in continuous service in America.

THE *Exporter and Importer*, published monthly by E. W. Fox, long a prominent and popular business man of St. Louis, is just such a journal as is demanded for the development and extension of domestic and foreign trade, between the great interior basin of the United States and other states and countries. It is a 32-page quarto, handsomely printed, and it starts off with an enthusiasm and breadth of scope which, if properly maintained and supported, will cause it to become an important agent in accomplishing the above named objects.

THE *Western Homestead* closes its first volume with the May number, and Major Burke is to be congratulated upon the success he has met with in inaugurating and firmly establishing this excellent family magazine upon a paying basis the first year.

THE *Science News*, heretofore published by S. E. Cassino, at Salem, Mass., has been purchased by Wm. C. Wyckoff, and will henceforth be published fortnightly at New York, under the personal management of Messrs. W. C. Wyckoff and Ernest Ingersoll. It is a valuable journal, and very low at $2 per annum.

WE are indebted to Lieut. C. A. H. McCauley, Third Cavalry, U. S. A., for a Report of explorations made by him in and about Pagosa Springs, Colorado, in the year 1878. It is a most interesting and instructive description of the remarkable hot springs, as well as of the general physical and mineral features of the surrounding country, illustrated by careful and well executed drawings done by Lieut. McCauley himself. In a future number we shall place before our readers some of the more interesting chapters.

THE article on "Ice Caves," published in this number of the REVIEW, was in type for the May issue, but the cut illustrating it failing to arrive caused its postponement. Mr. Ritchie, of the Boston *Science Observer*, who has probably made the first thorough examination of the subject in America, has sent us an exhaustive article, which will appear next month. Mr. Ritchie is very desirous of further facts, and will be glad to have any observer communicate with him.

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ARCHÆOLOGY.

ARCHÆOLOGICAL EXPLORATIONS IN TENNESSEE.

BY PROF. F. W. PUTNAM, PEABODY MUSEUM.

(*Continued.*)

With these articles of pottery should be mentioned the ring, made of the same material, which was found in contact with an under jaw, in one of the graves; also the pipe, of which figure 21 is a representation of full size. This was the only pipe found in the mound, and only two or three others, all of this material and shape, were obtained from the other mounds on Miss Bowling's farm.

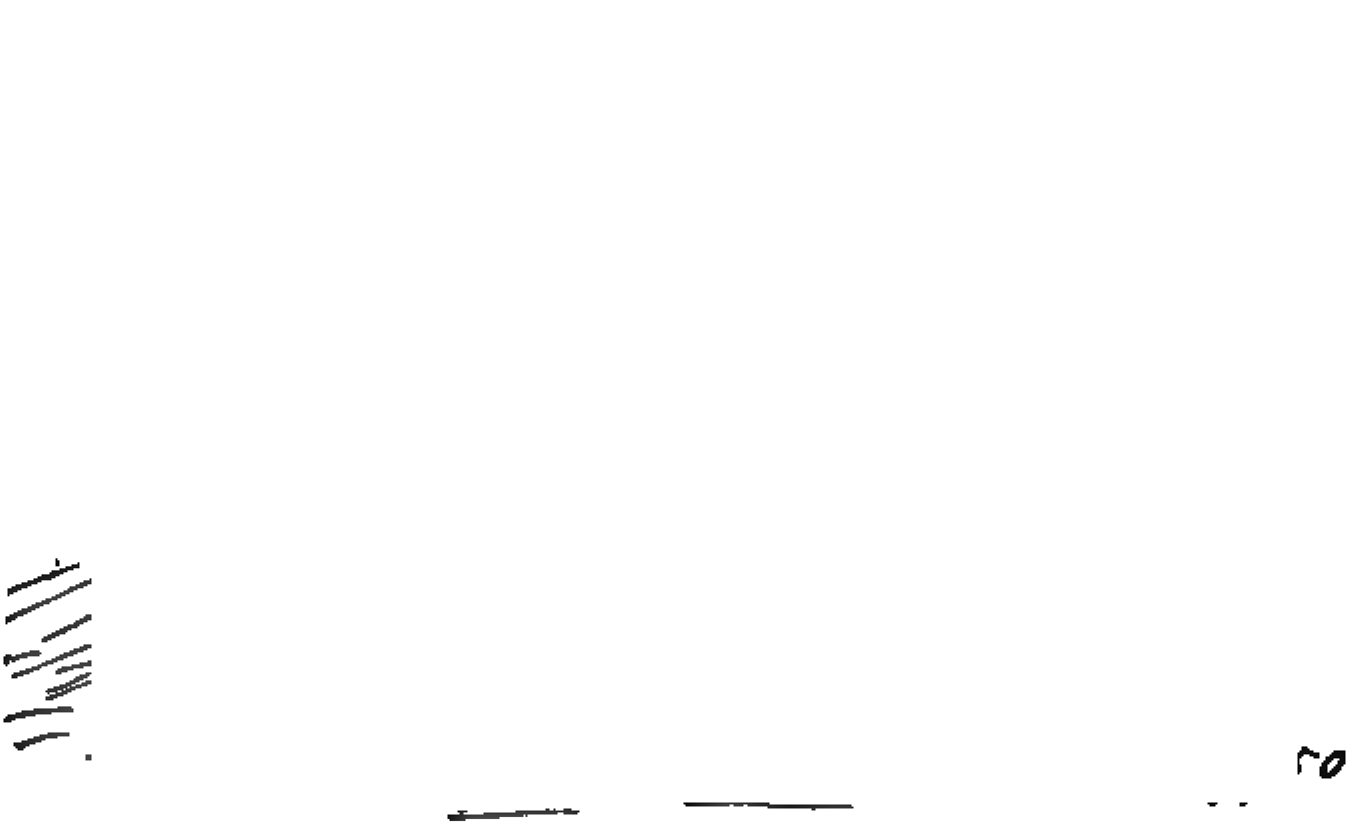
Among the articles of special interest found in the graves, were three rings of nearly uniform size, though made of different materials. One of these (Fig. 22) is made of a hard, green steatite, and is represented of actual size. It is perfectly symmetrical and highly polished, one and three-quarters inches in diameter and three-quarters of an inch wide. As shown by the figure, the central portion of the outer surface is cut out so as to leave a ridge around each

Fig. 12.

Vessel from Stone-grave Mound, Miss Bowling's farm. ½.

edge. The inner surface is slightly convex, the edges being rounded outwards. A similar ring of steatite of about the same size, from Pennsylvania, has been fig-

Fig. 13.



Vessel from Stone-grave Mound, Miss Bowling's farm. ½.

ured by Mr. Rau; and a few others, made of various materials, have been found in mounds and on the surface. The specimen here figured was in close contact with the under jaw of the elderly person buried in the grave, and in the same grave, near its center, was another ring, made of slate. This second specimen is one-eighth of an inch less in diameter and in width, than the one made of steatite, and differed from that simply in not having the projecting rims, it being perfectly flat and smooth on its outer surface.

Fig. 14.

Vessel from Stone-grave Mound, Miss Bowling's farm. Natural size.

The third example of these rings is made of well burnt pottery, and while it is of the same external diameter as the one made of

steatite, the thickness is slightly less. The width is the same as the one figured, and its outer surface is flat, like the specimen made of slate. This pottery ring, like the one made of steatite, was found in a grave and close to an under jaw.

Fig. 15.

Vessel from Stone-grave Mound, Miss Bowling's farm. Natural size.

From the fact that two of the three rings were found in the position stated, it may be surmised that they were labrets, and were in the lips of the individuals when buried. Their size is not as large as some labrets that have been described as used by Indians of the north-western coast; therefore there is no objection to the theory on account of the size of the rings, although, as they were found in only two of the many graves, their scarcity indicates they were not in common use. Of course, these rings may have been for an entirely different purpose than I have suggested, and the contact of two of them with the under jaws may have been accidental.

Fig. 16.

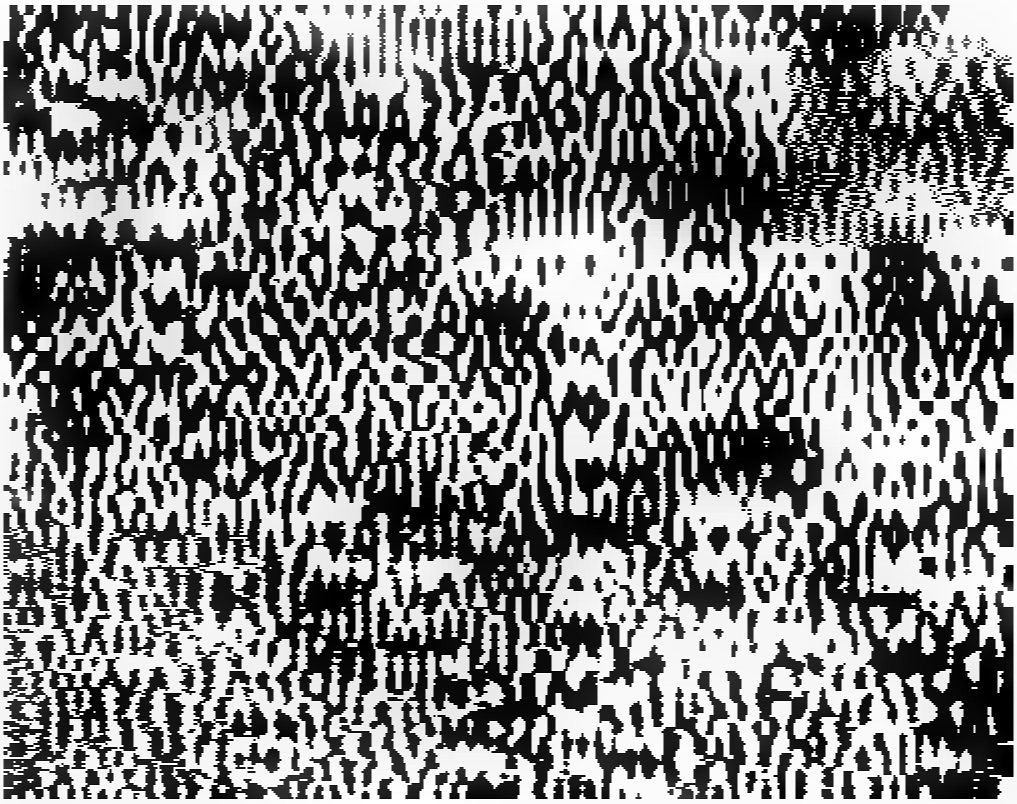
Vessel from Stone-grave Mound, Miss Bowling's farm. ½.

Implements made of stone, though often found on the surface in the vicinity of the old cemeteries of the Cumberland Valley, were not very abundant in these mounds, and were seldom found in the graves.

Out of thirty-one chipped implements obtained from the mounds on Miss

Bowling's farm, explored for the Museum, only five were found in the graves. The position of the others among the graves, however, shows that, like many of the articles of pottery, these stone implements had been left upon, or by the sides of, the graves, and hence are contemporaneous with them.

Fig. 17.



Vessel from Stone-grave Mound, Miss Bowling's farm. ⅓.

The chipped implements are of the several varieties of horn-stone and jasper, of which the majority of such articles found in the Southern and Western States are made. They are of various sizes, patterns and perfection of finish, such as are usually found together. One of the largest of these, which can be regarded as a knife, scraper, dagger, or spear-point, as fancy may incline, is represented of natural size (Fig. 23). This was found in grave 15, with several other articles, as already mentioned. Two other large implements (12339) would be classed as scrapers. They are five inches long and from two to two and a half wide.

Fig. 18.

Vessel from Stone-grave Mound, Miss Bowling's farm. ⅓.

One of them is made from a piece of black horn-stone, which has an impure nodule on one side that must have proved far less tractable to the worker than the rest of the stone, and may indicate that the scraper was used without a handle of wood, for the nodular part fits well to the palm of the hand and allows the opposite side to be freely used when so held.

The other scraper is made of a gray horn-stone, and its highly polished edges

and surfaces show that it had long been used, probably, simply as a hand-stone.

A still ruder form of scraper (11959), of the same material as the last, was found between the graves. This specimen is three and three-quarters inches in length by two and a quarter in width, and nearly an inch in its greatest thickness. It is as rudely made as many of the implements from the gravel bed at Trenton, described by Dr. Abbott, although of a material which is easily worked into delicate forms.

Fig. 19.

Vessel from Stone-grave Mound, Miss Bowling's farm. ½.

Another specimen (12338), of a light mottled gray hornstone, is a well made scraper with a beveled edge, and its size is such as to suggest that it had been attached to a handle. It is two and three-quarters inches long by one and a half across the beveled portion, the scraping edge of which is slightly convex. The opposite end of the implement is somewhat pointed and thinner at the edges.

From the scraper last described, the transition is easy to a small leaf-shaped implement of similar material, carefully chipped to a point and thin edges. This implement (12340) is an inch and three-quarters long, not exceeding in its greatest width three-quarters of an inch, flat on one surface and having a ridge along the opposite center. While it might be classed as a leaf-shaped arrow-point, it is more likely to have been mounted on a short handle for use as a knife, for which it is well adapted by its shape, point and edges.

Fig. 20.

Vessel from Stone-grave Mound, Miss Bowling's farm. ½.

An implement of a gray hornstone, three and three-fourths inches long, one inch in width and one-half an inch in thickness in the center, is interesting from its rather unusual shape, being pointed at both ends and decreasing in thickness in all directions from the center to the cutting edges. This was

found in the dirt between the graves, and is No. 12339 in the Museum catalogue. It is, in shape, like the implement figured by Prof. Jones (p. 138, fig. 75), but only about one-quarter of the size.

Passing to the spear-points, knives and arrow-points, there are several of interest, a few of which were taken from the graves.

The largest of these is a well-made, symmetrical spear-point (11958), four inches long, one and three-fourths in greatest width, and one-fourth of an inch thick at its expanded base, which is perfectly straight and flat. The stem is slightly notched.

Another specimen (12337), as long as the one just described, is somewhat thicker, but only one and one-fourth inches wide. This has a narrow stem without side notches.

Fig. 21.

Pipe of Pottery, from Stone-grave Mound, Miss Bowling's farm. Natural size.

Ranging between these spear-points and the small arrowheads, are ten perfect and several broken implements that may be classed either as spear-points, knives, or arrow-points. The largest of these (11957), and the only one having an approach to barbs, is shown in figure 24, of actual size. As will be seen by the figure, this is not a symmetrical implement, and its shape is such as to suggest its use as a knife, or dagger-point.

Two specimens, (12336–7) are about half the size of the last. One of these has a perfect and delicate point, and is slightly notched on the sides of the stem. Seven others are of various sizes and widths, between two and one-half and three inches in length, and all have short, straight, or slightly notched stems. One of these (12336, *a*) is much thinner and broader, in proportion to its length, than any of the others, and, mounted on a handle, would form a cutting instrument of no mean character.

Of three specimens from an inch and a quarter to an inch and a half in

length, that were probably arrow points, one (12341) has a fine point, an expanded and slightly convex base, and a notched stem. Another (12341, *a*) has a straight stem and a proportionally longer and more slender point. The third (11890) is short and broad, with a convex base, and that peculiarly shaped and abruptly made point which gives the impression that it was a broken specimen re-pointed.

Among the clipped implements of flint, was one that would probably be classed with the drills, or perforators. This was found in a grave, and is represented, of natural size, in figure 25.

Stone axes and celts have not often been found in the stone graves, though common among surface collections; and but two specimens were found in the three burial mounds explored under my direction, on Miss Bowling's farm. These are made of the same hard green-stone as the specimens obtained at Mr. Overton's place, previously described, and resemble them in size, shape and finish. The smallest is one inch thick, two inches wide and three and one-half long. The other one is of the same thickness, but is one-half of an inch wider and longer. The lower half of these small axes has been ground and polished on both sides, forming a central cutting edge like

Fig. 22.

Ring of Steatite, Stone-grave Mound, Miss Bowling's farm. Nat. size. 1877.

Fig. 23.

Chipped Implement, Stone-grave Mound, Miss Bowling's farm. Natural size.

the modern steel axe. The opposite end is left rough, and was probably inserted into a socket of wood or horn, like those from the Swiss lakes, some of which correspond very closely to the specimens from Tennessee, in material, shape and finish. Both of these specimens were found in one grave in the third mound.

In connection with these polished implements of stone, it is of interest to note a fragment of fine-grained sandstone (12344), seven inches long, four wide and two thick, which I found between the graves, in the burial mound here particularly referred to. This fragment is evidently a portion of a sharpening and polishing stone that had been long in use. Its opposite surfaces were concave, and were worn so deep by long use that they had nearly come together, and to this fact the breakage of the stone at this particular point was due. On the sides and in the large concavity of one surface, are small grooves and several deeply cut lines, formed by rubbing implements of different kinds on the stone. As will be inferred, this is a very interesting specimen, illustrating the method of polishing stone implements, and, with the three rings, probably as important as any obtained from this mound.

Fig. 24.

11957

Chipped Implement from Stone-grave Mound, Miss Bowling's farm. Natural size.

Fig. 25.

11870

Chipped Implement from Stone-grave Mound, Miss Bowling's farm. Natural size.

A water-worn stone (12345), six inches long, of oval form, was found in the second mound, and is of interest as furnishing conclusive evidence of the use of natural forms for the various purposes to which they may have been adapted. The stone in question is highly polished on one portion of its surface, and by holding it in the hand in the easiest manner, its adaptation for various rubbing purposes, which would cause the polishing of the particular portion showing use, is readily perceived.

Among the articles found between the graves in the mound, was the half of one of the thin, flat stones with two holes, which are generally classed as personal ornaments.

In mound 2, three discoidal, or "chungke," stones were found. One of these is made of white quartz, highly polished, and is three inches in diameter

Another, about half an inch greater in diameter, is made of a compact gray sandstone, and shows signs of rough usage on its fractured edge. The third is three inches in diameter, one and one-half thick, and is bi-concave. The material is rather coarse, hard sandstone.

Near the ash bed, which I have already mentioned as having been found under the lower tier of graves, north of the center of the mound, was found a fragment of talcose slate (11961), that probably once formed a portion of a cooking utensil of some kind, or perhaps a large vessel, or possibly a baking stone like those found in the shell-heaps of California. It is a well-worked piece of stone of nearly an equal thickness of about an inch, and on one surface, which is a little convex, slightly smoother than on the other. Near one edge there is a hole three-eighths of an inch in diameter. A careful search was made for other portions of this utensil, but only this was found, and its weathered edges show it to have been a fragment when left near the ancient fireplace.

A small mass of burnt clay (12346), containing the impression of several reeds which had been placed parallel to each other, was also found in the bed of ashes.

Implements made of the bones of animals have been found among the remains of pre-historic races in various parts of the world, and the graves, mounds and shell-heaps of America have furnished many examples of the typical forms. Pointed implements, made from the leg-bones of animals, particularly of the metatarsal bones of various species of deer, are the most common forms, and specimens from the mounds and stone graves of Tennessee are identical in shape and finish with those from the Swiss Lake dwellings.

One of these large implements (11904) here shown (fig. 26), of one-half its diameter, was found in one of the graves in the first mound explored on Miss Bowling's farm.

Other implements for like use were made from the antlers of deer, and two such (11895) were found in grave 15, which, as already mentioned, contained numerous articles. Another similar and pointed tool (11901), made from the leg bone of a large bird, was found in another of the graves in the same mound.

Splinters of bone were also utilized as awls and needles. Two such (11024), six and seven inches in length, and looking like knitting needles, were found in grave 25. These were probably made from pieces cut from the metatarsus of a deer and then polished and pointed. The smaller of these has a slight groove cut around the large end, as if for fastening a thread. The other, which is shown in figure 27, of one-half its length, is smooth and highly polished over its whole surface.

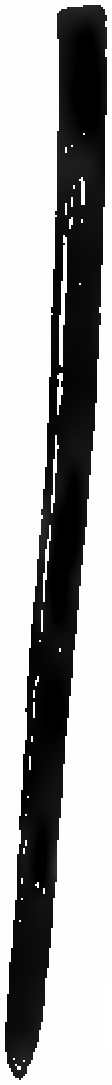
Among the articles found in grave 15 were six small splinters of bone, which have been carefully pointed at one end, and, in those that are perfect, the opposite end is notched as shown in figure 28, representing a perfect specimen of its actual size. These small bones were found close to the skull, and I believe them to have formed part of a hair comb, from this fact and from their close resem-

blance to the teeth of combs found in the graves in Peru, and their still greater resemblance to the wooden teeth in the hair comb once belonging to the famous Modoc, Captain Jack, and now in the Museum. This view was further substantiated by the discovery, afterward, in a grave at Lebanon, of several similar pieces of bone, also by the side of a skull.

Fig. 26.

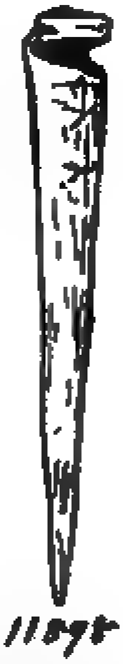
Implement of Bone, Stone-grave Mound, Miss Bowling's farm. ⅙.

Fig. 27.



Implement of Bone, Stone-grave Mound, Miss Bowling's farm. ⅙.

Fig. 28.



Pointed Bone, Stone-grave Mound, Miss Bowling's farm. Natural size.

Fig. 29.

Tooth of a Bear, Stone-grave Mound, Miss Bowling's farm. Natural size.

Several other bones were found in the graves of mound 1, but, with the exception of two wing bones of a large bird (11897), which may have been whistles, there was nothing to indicate that they were intended for special purposes.

Several teeth were also found, among them one of a large rodent, and two canines, probably of a young bear (11917), which were perforated, and, as they were found with a number of beads made of shell, near the neck of the skeleton, it is very likely that they formed part of a necklace. One of these teeth is figured (Fig. 29). Several shells of turtles (*Cistudo*) were found in the graves, and, though they do not show any signs of particular use, they may have been rattles, similar to those known to have been used by some of the Southern tribes, and still common among the Indians.

(*To be Continued.*)

PHYSICS.

THE PHONOGRAPH IN PARIS.

TRANSLATED FROM M. DE FONVIELLE'S "MIRACLES OUTSIDE THE CHURCH," BY MISS IDA HOWGATE.

About a quarter of a century ago, a young man who had just served seven years in a French regiment of cavalry garrisoned in Africa, came to Paris to seek honorable and lucrative employment. His was an earnest spirit, and one that the sun of Algeria had predisposed to bold thoughts.

He arrived in the great city at the time when all were in raptures over the discovery of telegraphy, whose wonders captivated the least sensitive minds.

This young man understood that the wonderful arrangement which permits mechanical force to be diffused at a distance was not the final wonder of electricity, and that it could be used in the conveyance of the visible word itself, as it already was in the conveyance of thought.

The exposition was then conducted by Mr. Paulin, its founder, a man of very great cleverness and industry. Wholly a stranger to the prejudice of the learned societies, he received with great favor the young inventor, who claimed to have solved an apparently insoluble problem, and offered him the use of the columns of his journal.

M. Bourseul described with great clearness the principles which he intended to apply, and he occupied himself with the task of carrying out his invention. He made application to a man already celebrated and who has given more than once in his career, proof of remarkable talents. M. du Moncel, who soon after commenced editing his great work on the applications of electricity, could not avoid honorable notice of the young soldier's claim. But he only mentioned it as one example of the exaggerations to which certain minds, excited by the fever of invention, do not hesitate to yield themselves.

This severe judgment carried the fatal blow to the hopes of M. Bourseul, who renouncing glory and fortune resigned himself to an administrative career, and entered a telegraph office where he still occupies an inferior position.

The invention of M. Bourseul was no other than that of the telephone, which is now in all hands, and which, one day or other, will radically transform telegraphy.

About twenty years after these events, M. du Moncel, as a member of the Academy of Sciences, was written to by an American inventor whose name was not better known than that of M. Bourseul, asking him to present to his colleagues

an apparatus which overthrew all previous knowledge of acoustics, and which, like the telephone, seemed to give a complete contradiction to the theories admitted by the University of Leipsic, and by that of Berlin to be as true as the words of the Gospel.

This stranger was Mr. Edison, and his invention was the phonograph, shown to all Paris during the year of the Exposition at the Capucines, and at the passage of the old opera house. M. du Moncel, who had learned how much it is necessary to mistrust some "*non possumus*" thundered out by the high priests of physics, received with favor the proxies of the stranger and invited them to perform their experiments before him.

When he was convinced of the reality of the phenomena, the learned author of *Applications de l'Electricite* begged the representative of Mr. Edison to follow him to the academy.

Rarely have we been present at so curious a spectacle. The enthusiasm of the majority of persons present was indescribable, greater according to some eyewitnesses than that of the audience of Arago, when that most illustrious of the perpetual secretaries of the Academy of Sciences, placed under the eyes of his fellow members the first proofs obtained by Daguerre, by the aid of photography.

But a few of the colleagues of M. du Moncel, among whom was noticed Dr. Bouilland, did not fear to manifest aloud their anger and incredulity. "It is an indignity," cried they, "to have the Academy exposed to tricks of juggling which a bold ventriloquist has just exhibited before it." "Do not you see that the operator never opens his mouth when he turns the crank of his instrument? etc., etc." Naturally these criticims were spread abroad, and excited some apprehensions among the persons who had only seen the experiments at a distance.

No doubt, however, had crossed my mind until an adventure, which I will relate, as it shows that the use of scientific analysis can, in certain cases, lead to errors not to be feared in a shorter investigation.

The day after I heard the phonograph for the first time, I was able to procure one of the tin leaves which had been used, and I hastened with it to a skillful optician. It seemed to me that in examining the traces left by the stylus the undulations necessary for the production of the articulated voice, could be estimated.

What was my astonishment when we, the optician and myself, discovered that the traces left by the stylus were of the most incredible simplicity. According to the very happy expression of an eminent practitioner, whom I consulted. "I have before my eyes a leaf of sheet-iron on which the marks of a point are left as by a hammer."

The result of this brief inspection was to incline me to the theory of ventriloquism. Cold perspiration covered my forehead. What would I not have given to regain possession of the imprudent articles which, on the faith of the Academy, I had written. I took a carriage and drove at full gallop to the office of the electric pen, in Bourse street, where the phonograph still remained, and which was a place of rendezvous for all scientific Paris.

I did not meet the operator, but a very agreeable American physician, who was employed on Mr. Edison's business.

"I know very well," said I, "that Mr. Pinkar is a ventriloquist, and that this phonograph ——"

"Do you also suspect me of being a ventriloquist?" answered he with a satisfied look. Politeness forbade me to say "yes," so I shrugged my shoulders in an incredulous way. "If so, follow me," he responded, "and the phonograph shall speak for you."

I climbed the staircase without being in the least disturbed by the assertion of my interrogator. But I had to declare myself beaten as soon I heard the first sounds go out from the paper horn, for I had so placed myself that no ventriloquist could have duped me. I took all precautions necessary, for a scientific examination, which in order to be efficacious does not need to be pedantic nor immoderately prolonged. On his side the operator did nothing to avoid any reasonable request without which, however, I would not have extended the examination further.

But the doubts which for an instant had made my conviction waver, had not disappeared from the minds of the academicians, better able than I, however, to proceed to a thorough scientific examination.

It is proper to add, that the noise made about some inventions, which have followed each other during these last months, all of which relate to electricity, has been of a character fitted to excite the jealousy of our Scientific Senate.

If ever these unworthy sentiments can be considered as justifiable, it is when they are produced by a seeming accumulation of success. We are no longer the perpetual secretaries, said one of the members of the bureau some time before these incidents, in referring to M. du Moncel. In fact all the inventors had recourse to the kindness of this affable scholar whose ability is established by so much work, and who, in welcoming the innovators with a courtesy very little academical, seemed to discharge a part of the debt which he had contracted against progress in repulsing, instead of encouraging M. Bourseul.

Toward the end of September, the storm burst forth in a comical way. M. du Moncel modestly asked permission to publish a letter of Mr. Edison's, but on a motion of a member of the committee this request was refused. The pretext was that this important document on the history of electricity had lost its flavor by an anticipated publicity.

Emboldened by the discourtesy of this attack, Dr. Bouilland arose to ask that they forbid M. du Moncel from holding a succession of experiments which have not been previously examined and superintended by a committee; in fact the credit of the society felt itself injured by the exhibition of sophisticated wonders; its reputation becomes conjointly responsible for the good faith of the inventors to whom M. du Moncel extends too lightly his all powerful protection.

The regulations of the Academy of Sciences contain a clause quite as singular as it is generally unknown. Under the pretext that it is not necessary to

infringe upon the opinions of fellowship, which the members of the Academy ought to feel for one another, it is forbidden to appoint any committee to estimate the value of their works or control their assertions. The members of great political assemblies are satisfied with the privilege of being judged with the consent of their colleagues, and, without the consent of this same body, they cannot be attacked.

More careful of their scientific dignity than the members of supreme assemblies, the academicians have conceived an arrangement in virtue of which they cannot be judged by anyone. Fortunately the public does not often need committees or managers to formulate an opinion, and the guilty ones cannot escape the severe condemnation which, sooner or later, the events themselves will pronounce.

In order to respond to this insult, M. du Moncel contrived to bring to the next meeting two of the condemned instruments, the phonograph and the singing condenser.

The talker of this last apparatus had been placed in the parlor, situated at the extremity of the hall—reserved for the sittings of the Academy of Sciences. The door had been carefully closed on the learned operator who had promised to place himself under the superintendence of M. Faye. Scarcely had the two celebrated academicians disappeared when the voice of M. du Moncel was heard coming from some leaves of a paper book placed on the table which is at the foot of the desk. His tone was transmuted in such a manner that the sound seemed produced by a bag-pipe or by a hautboy.

As M. Bouilland was allowed the privilege of taking in his hand the famous sheet of paper, of carrying it to his ear, and of satisfying himself that no ventriloquist had succeeded in creeping in among the leaves, the experiment did not last long. After the instrument had been removed, the meeting resumed its course and essays on the phonograph were read.

By this time not one of the spectators, who had stood motionless close to the wall, nor one of the members of the press had left his place. The ushers, standing gaping in expectation of the scandal about to take place, had forgotten to open the folding doors leading into the hall. Then there took place a scene unprecedented in the comical annals of the Academy of Sciences.

M. du Moncel gravely began to turn the crank, and to pronounce some common place words in the cornet. As the point had been carefully adjusted, the silver paper smoothed in a masterly way, the voice distinctly scanned, and the movement of the crank perfectly regular, the words were pronounced with a clearness entirely irreproachable. Then M. Bouilland, throwing himself on M. du Moncel, pinched his nose, which obliged him to open his mouth in order to breathe and, naturally interrupted the vertiginous movement of the crank. The shrill and ironical voice ceasing to come out from the horn, M. Bouilland imagined that it was because he had forced his colleaugue to open his mouth. "You see it?" cried he with a triumphant air, "you see it, gentlemen? When

I compel M. du Moncel to open his mouth, he can no longer be a ventriloquist, and his phonograph ceases to speak."

Two other members of the Academy desiring to convince a fellow member, in succession turned the crank. M. Bouilland threw himself on them with a fury which excites convulsive laughter in public and even in the assembly. Exasperated by the manner in which his demonstrations were received, M. Bouilland endeavored to show how ventriloquists go to work when they speak with the mouth closed and breath by the nose, but this manner of modulating sounds requires a practice, which the fiery doctor was very far from possessing.

When it was too late, the President saw that this scandal ought not to be prolonged, and he decided to suspend a meeting, which had already lasted too long, as the journal "*Electricite*" remarks in an energetic article which deserves to be repeated.

"M. Bouilland escaping criticism on account of a cerebral affection with which he was attacked, we will not speak of him, whose place is not in the Institute, but in another institution, situated on the borders of the Seine. But let us express our astonishment at seeing that Pres. Pizeau, a philosopher, authorizes scenes such as the dreadful meeting on the 7th of October last, which saddens all who have at heart the scientific dignity of France.

"In order to form for himself an opinion of the phonograph, did M. Pizeau, a philosopher, need such ridiculous experiments as ended the meeting?

"Did he also believe that the phonograph was a work of ventriloquism? Did he also wish to pinch M. du Moncel's nose and so make him open his mouth, in order to satisfy himself that he was not the author of the sounds which seemed to come forth from the cornet?

"If so, let M. Pizeau step down from a chair which he can no longer occupy without peril to French science.

"If otherwise, by what right did the President of the sad meeting on the 7th of October forget that he was the guardian of the dignity of the Institute—that he transgressed his authority in leaving the company, whose initiative he summed up, covered with ridicule by a scandalous scene? '*Presidence oblige.*'"

We must add, that although these scenes grieve us, they do not surprise us; in fact, we can not recall a single important invention, unless under the protection of one of the Academy, which has not been rejected.

Without M. du Moncel the phonograph would be condemned, as have been steamboats, railroads, electric telegraphy, etc., etc.

Although our national self love may be unquestionably wounded by this adventure, we will be consoled if it serves as a lesson for the future—if the public, warned by this scandal, understands the necessity of radically reforming an assembly where so many ignorant persons shade themselves under true illustrious ability.

A little resolution will suffice to regenerate this assembly, so near its downfall. "The Minister of Public Instruction," said a jester, "would only have needed a little strength to cleanse these Augean Stables."

REPORT ON AERIAL NAVIGATION.

The subject of aërial navigation as applicable to Polar explorations, is attracting much attention at present, and we present our readers herewith a report of an experiment made at the instance of Capt. Howgate last fall, by Edson C. Brace, Esq., at Scranton, Pa.

CAPTAIN HENRY W. HOWGATE, U. S. A.:

Sir—I have the honor to report that having been selected by you to witness the inflation of the "King Carnival" balloon, under the management of Prof. Samuel A. King, I proceeded hence yesterday from Washington, arrived here today, and performed the service indicated.

The inflation was accomplished, successfully throughout, in seven hours' time. Gas for the purpose was supplied by what may be termed a "five-foot" generator, of the Lowe pattern or build, which employs the modern method of a steam in conjunction with an air blast. Five "charges" or "turns" were required to fill the balloon. The amount of gas produced by each charge or turn approximated six thousand cubic feet. As will be inferred from the two last statements, the capacity of the balloon is about thirty thousand cubic feet.

I was assured by the foreman of the works at which the inflation took place, that the generator employed could have filled the balloon in less than six hours, and would have done so had not the operation been purposely delayed, which delay was occasioned by a state of weather somewhat unfavorable to the ascension, which Prof. King and I were to have made, but which was prevented by an unfortunate and a partly unavoidable accident. I was further informed by the foreman that the generator, which is the only one in the works, was capable of running off a charge or turn in something less than an hour.

The exact external dimensions of the generator are: height, eleven feet; diameter, five feet. It is cylindrical in shape, and has an inside fire-brick lining of about six or seven inches thickness—thus leaving a clear diameter for generating purposes, of less than four feet. About ten inches of the height are also taken up by the bottom lining.

The gas used for the inflation was made from anthracite coal and crude petroleum oil. The use of the oil rendered necessary the employment of a super-heater, which was connected with the generator. Prof. King objects to the gas produced by this combination for the reason, as he says, that it is too heavy for balloon purposes. He proposes, as I shall show by his own words, to dispense with the use of oil, in an apparatus he has in view for the generation of balloon gas, though he will retain the steam-blast feature of the process mentioned. The gas used in this instance was conducted through the super-heater, thence through the ordinary water-bath coolers, and thence directly to the balloon.

Within two hours after the inflation was completed the weather assumed such a favorable aspect as warranted further preparations for the contemplated ascen-

sion, and Prof. King proceeded, with the aid of a number of men, to tow the balloon from the gas-works yard to a public square of the city, whence the ascension was to be made. He had progressed but a short distance, however, when the balloon was borne, by a sharp breeze, against a "stand-pipe" in a reservoir, and so damaged that a collapse almost immediately followed.

The experiment demonstrated to my satisfaction the feasibility of filling a balloon of even two or three times the capacity of the "King Carnival" within a reasonable time, with a generator as small as the one described; the only possibility of failure existing in, or relating to, the gas-holding qualities of the material of which the vessel is made.

Prof. King made to me the following statement, which casts some additional light upon his views, as I understand you have ascertained them, concerning his contemplated portable balloon-gas-generating-apparatus: "As far as the Lowe process is concerned, I propose to use the same process. It is really the 'tessie demotay' process, but is used in connection with the old process. The Lowe has a super-heater—that is to say, he produces hydrogen gas made from steam passing through the coals, and gas made from crude-petroleum oil, which is allowed to percolate through the coals at the same time that the hydrogen is making; and the two gases pass through the super-heater, where, by means of heat obtained from the generator when blowing air through it, the two gases are chemically combined and form a 'permanent' gas—carbureted hydrogen. That is the only service the super-heater performs—it combines these two gases into one. The oil-gas is too heavy for balloon purposes, and consequently we want to leave that out, and leaving that out we consequently have no use for the super-heater. With that exception I propose to use that process. We pass steam through the incandescent coal. It comes from the generator an impure hydrogen gas, containing carbonic acid and carbonic oxide. The carbonic acid is then removed by a suitable and familiar process, and the carbonic oxide will remain with the gas We get, I think, forty-six pounds buoyancy to every thousand feet of gas. It will want a small engine—four-horse power is sufficient—and a small blower. The cylinder of the generator can be made in sections, of cast iron, if no fire-brick are used, and of wrought iron if fire-brick are used. The sections can be luted with clay and then bolted together. By this portable apparatus we can make the generator larger or smaller than the one we used to-day, at our preference or choice. It could be made smaller, I think, and yet answer every purpose in inflating balloons of ordinary size. I shall have such a generator made for my own use, and I have no doubt of its practicability, based on my experience. These brief notes I am giving you are wholly the result of my experiments and judgment in those matters."

Very respectfully, your obedient servant,

EDSON C. BRACE.

GEOGRAPHICAL NOTES.

NORDENSKJOLD'S EXPEDITION.

A letter has been received, via St. Petersburg, from Prof. Nordenskjold, under date of September 25, 1878, in which he announces that all the men connected with the expedition were well. This intelligence will set at rest the great anxiety about Prof. Nordenskjold's fate. There is little doubt that he will be heard from *via* Yokohama as soon after the ice breaks up as it is practicable for him to reach that port.

THE DUTCH ARCTIC EXPEDITION OF 1879.

It has been decided to send the little exploring vessel, the "William Bareutz," on another trip to the Arctic Seas this summer, sailing early in June. The scientific staff will resume the sounding and dredging operations of last summer, and try to reach Bareutz Icehaven, and build a suitable monument on the spot of the famous winter quarters of Bareutz. If time and circumstances permit, they will navigate the Kara Sea. Capt. A. De Bruyne and the Jonkheer, H. M. Speelman, are the only two members of the last year's expedition who will again serve —the former as commander and the latter in charge of the magnetical observations. Mr. W. G. A. Grant will again accompany the party as photographer. Lieut. Beynen will be replaced by two officers, Mr. Broekhurjen, Lieutenant 1st class, and Mr. Kalmeyer, Lieutenant 2d class. Mr. L. De Jeude, student at Utrecht, will go as Zoölogist. The crew will number nine men, instead of eight as last year.

AWARD OF MEDALS.

At the meeting of the English Royal Geographical Society, Monday, April 28th, it was announced that the gold medals of the Society had been that day awarded to Col. Nicholas Prejevalsky, for the great additions he had made to the world's knowledge of Central and Eastern High Asia, by his successive expeditions into the unexplored parts of the great plateau of Mongolia and the lofty deserts of Western Thibet, and for the admirable way in which he has described the regions traversed by him in the published narratives of his journeys; and to Capt. W. J. Gill, R. E., for excellent geographical work performed during two journeys of exploration, voluntarily undertaken, along the northern frontier of

Persia, in 1873, and over previously untraveled ground in China and Thibet, in 1877; also for the elaborate memoir and route maps contributed to the forthcoming volume of the Society's Journal.

A new African expedition is being organized at Lisbon, under the direction of Capt. Paiva d'Andrada. Its object is the exploration of the Zambezi and the foundation of commercial and agricultural colonies in the territories of Fete and Zoumbo.

The second session of the Congress of Commercial Geography, inaugurated at Paris last year, will be held at Brussels in September, under the presidency of M. Bamps.

No. 4 of *Petermann's Mittheilungen*, now edited by Drs. Behm and Linderman, contains, among other valuable papers, an interesting account of Capt. Howgate's "Florence" expedition of 1877-8, including a brief summary of the scientific results attained.

THE CENTRAL AMERICAN CANAL.

The representatives of the various countries interested in the establishment of water communication between the Pacific and Atlantic oceans, through Central America, met in Paris May 15th, to discuss the merits of the various routes that have been surveyed through the America isthmus. The delegate from the United States is Admiral D. Ammen, officially at the head of the Bureau of Navigation in the Navy Department, and who has been identified with the subject for years.

Among the different governments which have made extensive surveys in Central America, the United States occupies the first place. The latter has sent during the last decade various exploring expeditions to examine the routes by which a practical result could be expected. Since 1872 the following detail surveys have been made, viz.:

In 1872, the survey of the Isthmus of Tehuantepec, Capt. Shufeldt, United States Navy, commanding.

In 1873, the survey of the Isthmus of Darien, with surveys in the Atrato Valley and Napipi River, Commander Selfridge commanding.

In 1874, the Nacaragua survey, and in 1875, the survey of the Isthmus of Panama, with location of Canal, etc., between Panama and Aspinwall, Commander Edward P. Lull commanding.

The important labors of these different expeditions were performed with the most scrupulous care, and the high character of the gentlemen who composed them is a guarantee for the reliability of their reports. Besides the United States,

British and French explorations have been made in different parts of Central America with the same object. It was, however, not until M. de Lesseps, the originator of the Suez Canal, had identified himself with the scheme that practical steps were taken for the accomplishment of the canal. As a consequence of his endeavors, in which he was ably assisted by Lieutenant Commander De Wyse, of the French Navy, an international congress is now assembled in Paris, France, to examine the results of the different surveys and to decide, after a careful consideration, which route is most favorable for adoption.

The engineers who have examined the Nicaragua Isthmus have seen that no serious obstacles exist in the way of the enterprise, and, although their observations were confined to the line of the canal, they nevertheless gained a clear idea of the elements of wealth in which that region abounds.

We will give a brief description of the route across the isthmus and the estimate of cost necessary for the accomplishment of the work. The Central American States in general are very mountainous, and the various mountain chains and their branches intersect each other in every direction. Nicaragua alone is an exception in this respect. Four of its provinces—viz : Rivas, Granada, Leon and Chinandega, the principal ones as regards the development of their agriculture, commerce and manufactures—are level, especially the first named, which comprises the isthmus proper, and which has always been considered as the most suitable locality for the canal. The materials which would be required for the construction of the work are found in inexhaustible quantities in the provinces referred to. Lime and stone quarries abound along the line of the canal.

Nicaragua possesses among its various lakes two which are especially worthy of attention—viz., Lake Managua and Lake Nicaragua. The former, which is smaller than the latter and has twenty-two feet more altitude, flows into it through the Tipitapa River, and both together, with that natural canal, occupy an extent of nearly two hundred miles in length. The shortest distance between the great lake and the Pacific Ocean is not greater than ten miles, and, notwithstanding the curves of the line now proposed, which terminates at the port of Brito, the length of said line does not exceed sixteen miles. The great body of water which the great Nicaragua Lake pours into the Atlantic through the San Juan River, its small elevation above the average level of the two oceans (106 feet), the great relative depth of its waters, and other inestimable conditions, make that lake the true harbor of the canal, where all the squadrons of the world would at all times be able to find shelter.

It is very noteworthy that throughout the route proposed for the construction of the canal in Nicaragua, the maximum depth of the cut is so small that tunneling is entirely unnecessary; the insignificant elevation of the great lake above the level of the oceans reduces extremely the number of locks, an exorbitant number of which impedes general traffic.

The entire length of the proposed Nicaragua Canal, from ocean to ocean, is 181 miles, with a width of 150 feet and a depth of 26 feet. It is proposed to

make Lake Nicaragua the summit level of the canal, and to connect the lake with the Pacific by canal and with the Caribbean Sea by a combination of canal and slack-water navigation. The first section of the proposed canal from the lake to the Pacific leaves the lake at the mouth of the Rio del Medio, and extends for a distance of 7.58 miles, with an average depth of cutting of 54 feet. The second section extends from the end of the first to the Pacific Ocean, at Brito, a distance of 8.75 miles, making the total distance from lake to sea 16.33 miles. There would be ten descending locks in this section, each having a lift of 10.31 feet, besides a tide lock at the terminus of the canal, to admit ships at any stage of the tide. From the mouth of the Rio del Medio to Fort San Carlos, at the head of the San Juan River, the distance is 56 statute miles. Twenty-six feet of water can he carried to within 1,200 feet of the mouth of the Del Medio. Some under-water blasting would have to be done to deepen the channel to the end of the canal. On the east side a channel would have to be deepened by dredging for a distance of about seven miles, to a mean depth of about eight feet, the bottom being a firm mud, without rock. As the water is always perfectly smooth on this side of the lake, a dredge could work every day of the year. The eastern division extends from Fort San Carlos, at the lake, to the harbor of San Juan del Norte, or Greytown. It is 108.43 miles in length, of which 63.02 miles are in slack-water navigation, and 45.41 miles of inland canal. The San Juan is proposed to be made navigable by four dams, to be located severally at Castillo, Balas, Machuca Rapids, and a mile below the confluence of the river San Carlos, with short canals along these dams, with a lock of 10.28 feet lift in each. Just below the mouth of the San Carlos the canal would be taken from the river and located along the valley of the river to the head of the Juanillo branch of the San Juan, thence by an almost straight line toward Greytown, at a distance of 41.90 miles from the point of leaving the San. Juan at the mouth of the San Carlos. Out of this latter distance 36 miles would be in excavations and embankments combined, and 6 miles across low hills. Ten locks, 400 feet long and 70 feet wide, with walls 41 feet high, are proposed in this division, the first three located in the short canals around the dams, and the remaining seven in the lower part.

An artificial harbor is proposed to be made at Brito by means of a breakwater and dredging. Suez as well as Port Said are artificial harbors. The dredging would extend over an area of sixty-seven acres, which is thought to be sufficient to meet the traffic of the canal, particularly if the proximity of the lake is taken into consideration, where any number of vessels can find ample and safe anchorage.

At the Atlantic side the harbor of San Juan del Norte, or Greytown, would be made available and improved, the sand-bar removed, and the discharge of sand, brought down by the San Juan River, diverged by turning the lower waters of the San Juan into its Colorado branch. Careful and minute estimates for the accomplishment of this canal and accessories have been made by Civil Engineer A. G. Menocal, United States Navy. They are as follows:

For Western division, from mouth of Rio del Medio to the Pacific Ocean	$21,680,777
For Middle division, comprising lake navigation, from mouth of Del Medio to Fort San Carlos	715,658
For Eastern division, from San Carlos to Greytown; slack-water navigation, 63.02 miles; inland canal, 45.41 miles; or 108.43 miles.	25,020 914
For harbor of Brito	2,333,739
For harbor of Greytown	2,822,630
Total	$52,577,718
Add twenty-five per cent for contingencies	13,144,429
Giving a grand total of	$65,722,147

The construction of this work requiring neither tunneling nor the formation of a deposit of water, the length of the purely artificial canal being so limited, and considering the small number of locks, the costs of improving ports, and of accessory labor of less importance required, the estimate of $65,000,000 can be considered a close approximation to the truth. This outlay, which is by no means exorbitant for an enterprise of such transcendent importance, could be diminished to the amount of several millions by a more detailed location of the proposed line, by the value of lands which Nicaragua is disposed to grant in favor of the canal and by the sums with which she would now aid the immediate improvement of navigation in the San Juan River. Even suppose the amount required to be double of the above estimate, the commerce of the world would insure a remunerative interest. The Suez Canal, the cost of which cannot be placed at less than $400,000,000, whose success was so long a matter of dispute, and whose importance will undoubtedly always be inferior to that of the American canal, is now an enterprise whose future prosperity is more than assured.

Resolutions adopted by the St. Louis Medical Society of Missouri, April 26, 1879:

WHEREAS, The St. Louis Medical Society of Missouri, in common with other associations of liberal and scientific men, is deeply interested in the advances made during the last fifty years toward an exploration of the Polar regions and the attainment of the Pole itself, and are fully alive to the value of the additions to our knowledge already realized by successive expeditions up to the present time; and,

WHEREAS, Observations directly at the Pole, or in its vicinity, especially if prolonged and made with a systematic regularity hitherto unrealized, cannot fail to be of great importance to various departments of science and to the arts of life which are based upon scientific determination; be it, therefore,

Resolved, That this Society regards the proposed "Colonization Plan" of approach to the North Pole as the only one by which success can be reasonably anticipated, as well as the only one which can afford opportunities for the prolonged and systematic observation needed by science, whose results alone would far out-

weigh in value all pecuniary disbursement necessary for giving the system a full and thorough trial.

Resolved, That this Society hereby requests, and respectfully urges, the Senators and Representatives of the State of Missouri now in Congress assembled to support and vote for the proposed plan of Capt. H. W. Howgate for reaching the Pole, and for all measures designed to aid in carrying it into effect.

Resolved, That the Corresponding Secretary of this Society be instructed to forward a copy of these resolutions to each of our Senators and Representatives in Congress, as soon as practicable.

Resolution passed by the Merchant' Exchange of St Louis, Feb. 13, 1879:

WHEREAS, There is now pending in Congress a bill appropriating the sum of fifty thousand dollars to be expended under the direction of the President for the purpose of sending out one or more expeditions toward the North Pole; and,

WHEREAS, We believe that the plan of "Polar Colonization" advocated by Capt. H. W. Howgate, U. S. A., is the most feasible of any heretofore projected for the exploration of the Arctic regions, and for the discovery of the North Pole; and,

WHEREAS, Other nations are prosecuting, or about to prosecute, the plan proposed by an American; therefore be it

Resolved, That our representatives in Congress be requested to urge the passage of this bill, as we believe that it will reflect credit not only upon the men personally engaged in it, but upon the whole nation.

Resolution passed by the St. Louis Academy of Sciences, April 21, 1879:

WHEREAS, It is in harmony with the objects for the promotion of which this Academy was founded, to encourage enterprises calculated to increase our knowledge of the physics of the globe; therefore,

Resolved, That this Academy heartily approves Capt Howgate's plan of Polar colonization, and urges upon Congress to pass the bill providing for the expenses of the project.

GEOLOGY AND PALÆONTOLOGY.

THE NEW SINK-HOLE IN MEADE CO., KANSAS.

BY PROF. B. F. MUDGE, MANHATTAN, KANSAS.

Exaggerated accounts of this phenomenon induced the writer to make a visit to the spot and examine this singular freak of nature.

During the month of March last a sink-hole was found, where before was a smooth, grass grown prairie, crossed by a wagon road. The spot is 40 miles south of Dodge, in an unsettled portion of the state, with a very few ranches for stock-raising in the adjoining country. The wagon road is little frequented; and early in the month, those passing saw nothing new; but about the 18th the road was gone and a deep cavity in its place. As our party found it, May 5th, it had the appearance of a gigantic well, sixty feet deep and six hundred and ten feet in circumference, being nearly circular. More exaggerated dimensions have been published, but we made careful measurements. The walls were perpendicular, or nearly so; we had difficulty in finding a spot where we could go down to to the waters edge. The material of the soil, as far as we could see, seventeen feet deep, consisted of a firm clay-shale of reddish tinge. At the time of our visit there had been no rain, and the whole appearance was as fresh as if the subsidence had just taken place. All around the cavity were circular cracks, parallel to the rim, from five to fifteen feet or more deep and from one to ten inches wide. These had opened at the time of the catastrophe, and at first sight appear ready to cave in, but one of our party who visited the spot a month earlier, stated that these had not changed during that time. The arrangement of these cracks is different from those described by Lyell, as seen in sink-holes caused by earthquakes. Those radiate from the center, but these go round as imperfect circles. The most distant cracks were 126 feet from the rim, being most distant on the northwest side and less on the south side. We found the depth of the water at a few feet from the shore to be from 15 to 27 feet, at the center it was 42 feet. As the surface of the water was 17 feet below the surface of the ground, the total depth of the cavity was about 60 feet. The water is a strong brine, an analysis of which, by Prof. Geo. E. Patrick, of the State University at Lawrence, is hereto appended. It will be seen that it is about two-thirds saturation, which is much stronger than other salt springs in the State. This will give, deducting for impurities, one bushel of salt for forty-three gallons of the water. About seven per cent. only of impurities are present, but the amount of chloride of lime is objectionable.

I would take this occasion to express my thanks to Prof. Patrick for his kindness in making this analysis, as well as for other similar favors.

The position of the sink is on the side of a small, rounded hill, sloping gently to the east, and about 40 feet above the valley of Crooked creek, a tributary of the Cimarron river. The road ran just inside of the edge of what is now the cavity, and a buffalo trail ran directly across its center. The tops of the higher hills in the neighborhood are capped by a sandy concretionary limestone belonging to the Benton group of the cretaceous age.

This sink-hole is the more interesting as no instance of the kind has been known in this State. I examined the country in the vicinity, and could find no holes or depressions which indicated that any similar phenomena had occurred. Hunters and herders had seen nothing like it But nearly similar instances have been known in Kentucky.

My explanation of the phenomena under consideration is this: The Dakota sandstone crops out in Clark county, twenty miles distant, and dips at a small angle toward this spot, and undoubtedly underlies the whole of Meade county. This sandstone is quite soft in some of its strata, and covered by harder beds. The softer portions are liable to be washed out by subterranean waters, and thus form caverns which are roofed by the hard layers. The cavern in this case became enlarged until the roof was unable to sustain the over-lying prairie soil and shale, sixty feet in thickness, and the result is what we now behold. As what was the grass-grown prairie is now the bottom of the cavity, the height of the cavern must have been at least sixty feet, and its floor at least twice that distance (120 feet) below the traveled road. If it is still spread out in smaller chambers, other depressions like the present may occur.

The following is an analysis of the salt water from the Meade county sink-hole, by Prof. Geo E. Patrick, of the State University, Lawrence, Kansas:

Specific Gravity, 10.719.	Grains per U. S. Gallon.
Sodum Chloride (Common Salt)	9.886.7
Calcium Chloride (Chloride of Lime)	365.9
Magnesium Chloride,	259.4
Calcium Sulphate,	207.1
Total	10,719.1

There is an entire absence of iron, potassium and lithium; gases practically none, and organic matter none.

PROF. MARSH ON THE FOSSIL POLYDACTYLE ANCESTORS OF THE HORSE; AND RECENT EXAMPLES.

PROF. E. L. BERTHOUD, GOLDEN, COLORADO.

Prof. O. C. Marsh, in the June number of the *Journal of Science*, has given to the scientific world an article of exceeding interest on polydactyle horses, both recent and extinct.

The learned professor, some years since, gave a trite, interesting and very suggestive article on the development of our present horse from the most remote ancestry of many-toed ungulates, which his fossil discoveries in Utah, Wyoming, Colorado and Nebraska enabled him to do, and which he has turned to such good account as an irrefutable argument in proof of evolution. Recent discoveries have added one more link to his deductive theory, and in the article above referred to and just published he gives us an almost complete sequence.

To-day the scale of Prof. Marsh's equine development is thus succinctly given:

"The original ancestor of the horse, not yet discovered, undoubtedly had five toes (or hoofs) on each foot."

The next in the ascending scale, very recently discovered at the base of the Eocene, the oldest Tertiary formation, was an animal as large as a fox. It had on each fore foot four toes and the rudiments of a fifth, and three toes on its hind feet. This quadruped is called "Eohippus," literally the "dawn of the horse."

The next in the scale is called by him "Orohippus," also in the Eocene; had four toes on each fore foot, three on each hind foot; was no larger than Eohippus.

There comes with it, but higher in the Eocene, another allied genus, with the same number of toes, but with different dentition. Thishe called "Epihippus," a slight modification that points already to a still further change in the ascending scale.

Following the Eocene Tertiary comes the Miocene Tertiary, which is sharply and well defined in geological age from the Eocene. In this division of the Tertiary, we conceive, took place the last and most serious modifications, that have resulted in causing the present conditions of climate temperature, the seasons as now occurring, the total annihilation of Arctic vegetation and its accompanying animal creation, which undoubtedly then existed in high latitudes. Can we then but admire the sagacity of Prof. Marsh's deductions, when from such ancient fossils as a few petrified bones, a few fossil teeth, he produces and reconstructs another link in his equine sequence. From the lower Miocene comes now the "Mesohippus," as large as a sheep, with three toes on each hind foot, three on each fore foot, with a fourth or rudimentary one on each side. We rise still higher in the Miocene, and he finds a still further modification, the "Miohippus," where the fourth, rudimentary toe of the Mesohippus is reduced to a mere short remnant of a splint bone.

The Miocene is passed, and we come now to the Pliocene, the most recent of the Tertiary formations. Here he finds the three toed horse, "Protohippus," literally the "first horse" is the meaning of that term—an animal, he tells us, as large as a donkey. Thank heaven, we have no mules of that kind. A merciful Providence has kindly closed out that race of animals, for our modern mule, if gifted with such an array of hoofs, would render this globe almost uninhabitable, and profanity would be inadequate to do justice to such a periphery of kicks!

Following the Protohippus, we now find another, still more perfected and selected animal, the "Pliohippus," or the "horse of the Pliocene," with only one hoof or toe on each foot, and with a true splint bone on each side of the single toe. Succeeding the Pliohippus appears a true fossil horse, as large as our existing horse, and we have the series completed.

Thus far in the series, from the less perfect to the present form, the learned, sagacious Professor has shown by the marvelous precision of his inductive reasoning that an undisputed evolution, reaching, we might say, far into the "night of ages," but only on the threshhold of geological chronology, has undoubtedly taken place. Yet may we not despair that even the age of the Eocene may be numbered and its duration counted from to-day in a close approximation.

Prof. Marsh, after his exhaustive examination of the probable (we might almost say the certain) descent of our present horse from the far-back ancestry of the Eocene five-toed ungulate, has given us a striking example of what seems to be in our modern horse a reversal to the primeval one-toed horse of the Pliocene. This is an example that the author of this sketch has himself seen, namely, a horse with a rudimentary, well formed toe on the inner side of each leg, ending in a small hoof, in no manner interfering with the prompt action or the rapid gait of the animal gifted with such apparently superfluous appendages. The importance of this observation which if further proved to be not an isolated example (of which Prof. Marsh says he has two or more examples well authenticated), is clear, and we have an almost absolute proof that the learned professor's filiation of descent of our present equus is at least pretty well demonstrated, and the Pliocene "Hipparion," or Protohippus, is the remote and immediate ancestor of the Pliohippus, the one-toed horse of the Pliocene.

It is needless here to go over the ground, so often discussed, of the imperfection of our geological record and its accompanying fossils. Suffice it to say that every day we discover new and unknown species. The gaps that thirty or forty years ago left such uncertainty in the generic succession of species, both vertebrate and invertebrate, in the different geological ages, are being rapidly bridged, and we do not doubt but that ere long other intermediate forms must be found, showing still more clearly the slow but sure changes that vast periods of time effected in the progressive development from the Eohippus to the Pliocene horse.

ASTRONOMY.

MARS INHABITED, LIKE OUR OWN EARTH.

CAMILLE FLAMMARION.

[*Continued.*]

But to what cause are the clouds of Mars due? Evidently, like ours, to the evaporation of water. And the ice? Evidently, also, to the congelation of water. But is it the *same kind* of *water* as we have here? Some years ago this problem remained unsolved. To-day it is possible to answer it.

The marvelous processes of spectroscopy have been applied to the study of the planets, principally by the learned English physicist, Huygens. Now the planets reflect the light that they receive from the sun; when we examine the spectrum of their light, then, we see the solar spectrum as if reflected from a mirror. By directing the spectroscope toward Mars, it was ascertained at first that, in the luminous rays given forth by this planet, there was a perfect identity with those which emanate from the central star of our system. But, by using more accurate methods, it has been found, during the later appositions of the planet, that the spectrum of Mars is crossed in the orange zone by a group of black bands *coinciding with the lines* which appear in the solar spectrum *at sunset.* What atmospheric substance is it that produces these lines? By examining their position it is ascertained that they are due to the presence of neither oxygen, nitrogen, nor carbonic acid, but to watery vapor, which is distributed through the atmosphere of Mars in as large a quantity as it is in our own. The green spots of this globe are indeed seas—expanses of water analogous to those of the earth. The clouds are indeed vesicles of water solidified by cold. And further, this water being, as shown by the spectroscope, of the same chemical composition as ours, we know, moreover, that oxygen and hydrogen are there also

These important proofs permit us to form an idea of the meteorology of Mars, and to see therein a very similar reproduction of that of the globe we inhabit. On Mars as on the earth, in fact, the sun is the supreme agent of movement and of life, and its action determines there results analogous to those that exist here. Heat vaporizes the water of the seas and carries it aloft into the atmosphere; this watery vapor assumes a visible form through the same process that gives rise to our clouds—that is, through differences of temperature and saturation. Winds arise through these same differences of temperature. We are able to follow the clouds as they are borne along by aerial currents over the seas and continents; and many an observation has, so to speak, photographed these meteoric varia-

tions. If we do not literally see the rain fall, we at least take it for granted, since the clouds dissolve and are again renewed. If we do not see the snow fall, yet we assume that also, since, as with us, the winter solstice is occompanied by hoar frosts. Thus, there as here, there is an atmospheric circulation, and the drop of water of which the sun robs the sea, returns to it again by falling from the cloud which harbored it. And more, although we should firmly guard ourselves against creating imaginary worlds fashioned in the image of our own, yet the one under consideration presents us, as if in a mirror, with such an organic similitude, that it is difficult not to go a little further in our description.

In fact, the existence of continents and seas shows us that this planet has been, like ours, the seat of interior geologic movements which have given rise to upheavals and depressions of the land. There have also been earthquakes and eruptions that have modified the primary uniformity of the globe's crust. Consequently, there are mountains and valleys, plateaus and basins, steep ravines and cliffs. How do the rain-waters return to the sea? By springs, brooks, creeks and rivers. So it is not difficult to see on Mars scenes analogous to those that form our terrestrial landscapes; purling brooks flowing over their beds of sun-gilded pebbles; rivers crossing plains, and falling in cataracts to the bottoms of valleys, or slowly descending to the sea over their beds of fine sand.

The sea shores there, as here, receive the tribute of aquatic canals, and the sea is now calm and mirror-like, and now lashed by tempests; it is also agitated by a periodic movement of flux and reflux, since the planet has two moons to produce these tides.

So, then, there is in space, at some millions of miles from here, an earth almost like our own, where all the elements of life are collected, as they are about us—water, air, heat, light, winds, clouds, rain, water-courses, and mountains. To complete the resemblance, we will also remark that the seasons there have almost the same intensity as ours, the axis of the planet being inclined 27° (ours is inclined 23°). The length of the day is 40 minutes greater than ours; it is exactly 24 hours, 39 minutes and 35 seconds.

Before all this, is it possible to stop for a single instant at the statement of these elements and these movements without considering the effects that they have produced, and that they are to produce? The physico-chemical conditions that have given birth to the first vegetation that appeared on the surface of our globe being realized up there as they are here, how could they have been in presence without acting in some way or another? Under what scientific pretext can we imagine an arbitrary prevention of the realization of these results? The fact is it would require an incomprehensible interdiction, a supreme veto, something like a permanent annihilation, to prevent the rays of the sun, the air, the water, and the earth (those four elements divined by the ancients) from entering at every moment into an organic evolution. While the least drop of water teems here with myriads of animalcules, while the ocean is the abode of thousands of animal and vegetable species, what effort would not our reason require to imagine that in

the midst of like vital conditions, the world under consideration has been able to remain eternally in the state of a vast and useless desert?

Such is the chemical and physical knowledge that we have concerning this planet; we may complete it by an examination of its special mechanical conditions, such as its weight, its volume, its density, and the force of gravity at its surface.

The diameter of Mars is to that of the earth as 5 to 8; that is to say, it is almost half smaller. It is 4,400 miles in mean diameter, while the mean diameter of the earth is 7,912 miles. The surface of Mars is consequently two and a half times less in extent than that of our world. The total weight of the planet, or its mass, is only one-tenth of the weight of our globe.

The mean density of the materials which compose this planet is less than that of the constituent matter of the earth, being 71 per cent. As a result of this density and of the dimensions of Mars, the weight of a body at its surface is extremely light. So the force of gravity at the surface of the earth being represented by 100, it would be only 38 at the surface of Mars, which, indeed, is less than it is on any other planet of our system. The consequence is that a terrestrial pound avoirdupois, transported thither, would weigh only about 6 ounces. A man weighing 150 pounds, transported to Mars, would not weigh 60 pounds. He would be no more fatigued from running 5 miles, than he would be from running 2 miles on the earth. The muscular effort brought into play by boys during the game of "leap frog," would, on the surface of Mars, not only permit them to jump over the backs of their companions, but even over the roofs of houses and tops of trees. A study of modern statistics demonstrates scientifically that man is the product of the terrestrial planet, so far as organization is concerned (his soul being left out of consideration, a matter of which we will not speak here). His weight, his stature, the density of his tissues, the weight and size of his skeleton, length of life, periods of work and sleep, the quantity of air he breathes, and the food he assimilates, all organic functions, even those that seem most arbitrary, and even to maximum periods of birth, marriages, and deaths—in a word, the human machine all entire is organized by the planet. The capacity of our lungs and the form of our chest, the nature of our food and the length of our digestive tube, the gait and the form of the legs, the sight and the construction of the eye, the thought and the development of the brain, etc., etc., all the details of our organism, all the functions of our being, are in intimate, absolute, permanent correlation with the world in the midst of which we live. The anatomical construction of our body is the same as that of the animals which precede us in the scale of creation. We are made as we are, because the mammiferous quadrupeds are made as they are; and so all species of animals follow one another like the rings of the same chain; and, in ascending from ring to ring, we find the first rudimentary organisms which are still more *visibly* yet none the less the product of the forces which have given them birth. This truth recalled, we see that the terrestrial human form has nothing arbitrary, that it is the result of the state of the planet, and that, consequently, it

differs on every planet according to the organic conditions of each one, which are so unlike those of another.

In tracing the formation of the zoölogical series, we may conjecture that the succession of species will have been strongly influenced, on Mars, by gravity. While that here the great majority of the animal races has been obliged to remain close to the surface of the soil through terrestrial attraction, and that a very small number have received the privilege of wing and flight, it is very probable that, owing to a very special disposition of things, the Martial zoölogic series has been developed by preference through a succession of winged species. In this case, the superior animal races are there furnished with wings. On our sublunary sphere, the vulture and the condor are the kings of the aerial world; up there the great vertebrate races and the human race itself (which is the result and last expression of it) have the very enviable privilege of enjoying aerial locomotion. The fact is so much the more probable, inasmuch as to the less gravity is added the existence of an atmosphere analogous to our own and perhaps more dense. So it is almost certain that the *inhabitants of Mars are of a different form from us, and fly in its atmosphere.*

Finally, let us add that this interesting planet proceeds in the heavens accompanied by two satellites. This recent discovery is one of the most curious in contemporaneous astronomy. It was made in 1877 by the aid of the great telescope at the Washington Observatory, and the best in the world. The American astronomer, Prof. Asaph Hall, undertook an attentive examination of the surroundings of Mars, from the beginning of the month of August, 1877, and a diligent observation of this neighboring planet during the whole of the favorable period of its greatest proximity to the earth. In masking the disk of his instrument to avoid the influence of light, he had the pleasure of discovering, on the 11th and 17th, two little luminous points which were accompanying the planet in its celestial march, and of observing them long enough to determine their orbits. This news was received like a thunder-clap by European astronomers, half of whom remained incredulous until they were fully informed. But the discovery was soon verified absolutely.

These two satellites are minute worlds—the smallest that we know. The first appears to be about 7½ miles in diameter, and the second 6 only. They are, indeed, only the breadth of Paris! And yet they are perceived at a distance of 45.000,000 miles. In size they are not even terrestrial continents, nor even empires, nor even provinces, nor even departments. Alexander, Cæsar, and Charlemagne would have cared little to receive the scepter from them. Gulliver would have played with them, as a juggler with his balls; Micromegas would have forgotten them in his fob.

However, who knows? The vanity of men being generally in direct ratio to their mediocrity, it is very probable that the reasoning microscopic mites that swarm on their surface also take pride in possessing armies which tear each other in pieces for the possession of a grain of sand.

Such is the general physiology of this neighboring planet. The atmosphere which surrounds it, the waters which irrigate it, the sun's rays which warm and light it, the winds which sweep across it from pole to pole, and the seasons which transform it, are so many elements for creating an order of life analogous to that with which our planet is provided. The low force of gravity at its surface must have particularly modified this order of life by adapting it to its special condition. So hereafter the globe of Mars ought no more to present itself to us as a block of stone turning in space in the sling of solar attraction, as a sterile, inert, and inanimate mass; but we ought to see in it a living world, ornamented with landscapes, where the noise of the wind is heard and the water reflects the light of heaven, a world peopled with numberless beings hovering about in its atmosphere—a new world that no Columbus will reach, but upon which, however, a human race now dwells, works, thinks, and, no doubt, meditates, as we do, on the grand and mysterious problems of nature.

THE APPROACHING CONJUNCTION OF MARS AND SATURN.

PROF. C. W. PRITCHETT, MORRISON OBSERVATORY.

As you desire short and familiar articles on astronomical subjects, it may not be amiss to call the attention of your readers to the very interesting conjunction of the planets, Mars and Saturn, which occurs on the 30th of the present month, (June).

True, neither of these planets will be visible above our horizon, at that date, until about twenty-three minutes past midnight; yet as so favorable a conjunction rarely occurs, (the last having occurred April 18, 1817) some may be found to take sufficient interest to watch, once in a lifetime, these ancient members of our solar system, as they approach and pass each other in their orbital revolutions.

An observer who will take the pains to examine the eastern heavens, June, 30th, (civil time,) at any hour of the morning between 1 o'clock and the dawn of day, will see these two planets very close together. Mars will appear *west* of Saturn about thirteen minutes of arc, or less than half the diameter of the moon. He will also appear *south* of Saturn, about four minutes of arc. The yellow-red of Mars will appear in strong contrast with the dull white of Saturn. If the observer is furnished with an instrument of sufficient power, he will find the diameter of Saturn, *then*, to be 17.1 seconds, while that of Mars will be 8.8 seconds.

Now, remembering that both planets are moving northward and eastward, and Mars about fourteen times faster than Saturn, let us suppose that our observer could move westward round the earth in twenty-four hours, so as to keep the two planets all the time in full view, the sun being two hours or more below his horizon during the entire circuit. On reaching the Pacific Coast, he would find the planets perceptibly nearer each other, than when he left the Eastern States, the distance being now reduced to eight or ten minutes of arc. Moving

on through the islands of the Pacific, he would find them approaching nearer and nearer still, till he reached Australia or India. At the observatories at Melbourne and Sydney, N. S. W., the two planets could be seen at their nearest approach; and the great circle arc joining their centers, would *then be* only 1′ 13″ in length. Our traveler continuing his journey homeward through India, Europe and across the Atlantic, and having the planets still in view, would find Mars passing northward and eastward of Saturn, so that on reaching the eastern coast of America, he would find the position of the two planets nearly the reverse of their positions twenty-four hours before, while in the mean time he would have seen all the successive phases of approach to be had in different longitudes. The time of nearest opproach of centers will be very nearly seven hours and thirty minutes Greenwich mean time, corresponding to one hour and nineteen minutes Glasgow mean time—that is at nineteen minutes past 1, P. M., June 30th, of Glasgow M. T., and when the planets have set to us, the observer at Melbourne, Sydney and Madras, will see the planets above their eastern horizon with their centers only seventy-three seconds apart, and their limbs only one minute apart. It is a source of much regret to the astronomers of Europe and America, that geographic position will prevent them from making either photographic, photometric or micrometric observations of the two planets while in their most favorable positions. Such observations are reserved for the astronomers of the Pacific islands. This fact serves to show the importance to science, of having observatories distributed at short intervals all around the earth, and in both Northern and Southern hemispheres. Thanks to English enterprise, there are good observatories at Melbourne, Sydney, Calcutta and Madras, and their astronomers will no doubt give a good account of themselves in these observations.

The following remarks of Sir Geo. B. Airey, the venerable Astronomer Royal of England, were communicated to the Royal Astronomical Society in December last. I quote them from Monthly Notices of January:

"Different observers will make use of this phenomenon for different purposes. The instrumental measurement of the relative positions of the two planets will give a test of Leverrier's tables in parts of their orbits where it could not otherwise be obtained. I look with much interest to observations of the colors of the two planets. At the conjunction of 1877, November 3d, the distance between the planets rendered it impossible to see them in the same field with a high power on the telescope, and therefore impossible to receive from them any large pencil of light. I did myself observe them with a good surveyor's hand-telescope, and was much struck with the result as to their colors. While Mars had his usual fiery yellow-red color, Saturn was of deep sap-green. How much of this color was due to contrast with the predominant blaze of Mars, I cannot judge. In the approaching conjunction, Mars will be much smaller, and the colors can perhaps be compared more justly."

I may add, that our supposed observer, in making the circuit of the world in advance of the planet, on reaching the Sandwich Islands, or some of the more

western groups, would, if he had a telescope of sufficient power, be able to see Mars pass in between the outer ring of Saturn and his outer satellite, Japetus—approaching this satellite, according to the computation of Mr. Marth, of London, within thirty seconds.

I hope that some of your readers may be induced, even at the expense of a morning nap, to look at these planets, at least on the mornings of June 29th and 30th, and of July 1st.

PLANETARY PERIHELIA AND PESTILENCE.

BY PROF. ELIAS COLBERT.

[The following article, by our friend, Prof. E. Colbert, of Chicago, was written by him in response to numerous letters asking his opinion relative to the theory of Dr. Knapp. We might add, also, that Prof. Watson of Ann Arbor, Prof. W. Harkness of Washington, and other well known astronomers who have also been appealed to, uniformly express a similar opinion to that given below.—EDITOR.]

The years of perihelion passage will be: Jupiter, 1880; Neptune, 1881; Uranus, 1882, and Saturn, 1885. Also, about the 28th of May, 1881, the planet Mars will also be in the perihelion point of *his* orbit. In order to ascertain the momentum of these facts as bearing upon sublunary things, we note:

First.—The perihelion of a planet's orbit is not a substance or thing that can exert an influence, neither is it a point that always preserves the same position in the heavens with reference to the stars. If any effect be due to the passage of a planet through its perihelion, it must be simply because the planet is then *nearer* than when in any other part of its orbit; and it is a necessary inference that the effect may be mathematically correlated to some function of the distance.

Second.—The most reasonable supposition with regard to this interdependence of power and distance is that the effect varies inversely as the square of the distance. That is the relation known to exist in the case of the attraction of gravitation, and light and heat. If it be claimed that the effect is electric, or magnetic, then we have no good reason to suppose that any other ratio prevails, since in the absence of any lineal conductor (as a piece of wire), any definite quantity of power radiating from any point must be distributed over an area the magnitude of which is directly proportional to the square of the distance; wherefore the quantity of power impressed upon a square foot or a square mile of such affected area will be in inverse proportion to the square of its distance from the source of such power.

Third.—The planets are always shining, and each one is always attracting its fellows away from the average path around the sun. It would be absurd to suppose that they are not always acting magnetically, or electrically, if they do so

when in perihelion. It is, therefore, a logical inference that the disasters referred to, if due to perihelion passage, must be due to the excess of the perihelion force above the average force—that is, the difference of the two. This is very nearly equal to the eccentricity of the orbit divided by half the product of the perihelion distance and the mean distance. The mathematical reader can easily verify this statement; the non-mathematical reader must take it for granted.

Fourth.—The gravitating influence of a planet, for equal distances, is directly proportional to the quantity of matter it contains, which, for equal densities, is proportional to the cube of the diameter. If distance and intrinsic illuminating power be both equal in any two or more cases, then the light received would be proportional to the surface—that is, to the square of the diameter. In the case of magnetic or electric excitation, the ratio of exerted force must certainly not be outside these limits. In the case of the superior planets, which are charged with the crime of making their perihelion passages almost instantaneously, it is approximately correct to say that their quantities of matter, and intrinsic luminosities, are in the above-named ratios; so that, without glaring error, we may apply the same reasoning to each of them.

Fifth.—We may now inquire, Is the influence of these planets on the earth a direct one? that is, does it vary with their varying distances from our planet? If yes, we meet at once this important fact, that the differences between their mean and least distances are less than the distance from the earth to the sun. These differences are, for Mars, thirteen millions; Jupiter, twenty-three millions; Saturn, fifty millions; Uranus, eighty-three millions; Neptune, twenty four millions, while the earth distance is between ninety-two and ninety-three millions of miles. The earth, therefore, in each annual revolution, changes her distances from each of these bodies more than the change of distance with respect to Uranus once in eighty-four years, which should give a pestilential visitation every twelve months. In the case of Jupiter, which is claimed by Dr. Knapp and others to be the most potent of all, the difference of distance is only about one-quarter; and, according to the hypothesis most favorable to the theory of planetary epidemic, the difference of action is only one-sixteenth (square of one-quarter) as much every twelfth year, due to Jupiter's period, as it is every year, due to the earth's annual motion. If, when the earth is in line between the sun and Jupiter, we can detect the least excess of electric, magnetic, or actinic force above the mean, we may, perhaps, be justified in asserting that an augment of one-sixteenth part more will cause dire disasters. Otherwise, certainly not. We might easily show figures that the combined excess of all four of the larger planets, when acting together at simultaneous perihelion, would not be more than (say) one-tenth of that due to the earth's yearly change of distance from Jupiter alone. The idea of earth epidemic, as directly due to excessive action by the planets when at or near their perihelia, may, on this showing, be fairly called absurd.

Sixth.—The most plausible hypothesis is that the planets will act on the earth

indirectly—through the medium of the sun; that they will excite him to unusual energy—luminous, magnetic or otherwise—and that this will cause the predicted epidemic. The idea is not new, and has, besides, the merit of having been advocated by some great men. The statement has been admitted into at least one scientific text book, that there appears to be a connection between the periods of sun-spot vigor and the periods of revolution of Venus, Jupiter, Saturn and Uranus. A little figuring will enable us to form some idea of the value of this theory as applied to the case in point. Taking the quantity of matter in the earth and her mean distance as the units of measure, and dividing the mass by the square of the distance, we have for relative power on the sun: Earth, 1; Jupiter, 11.40; Saturn, 1.02; Uranus, 0.04; Neptune, 0.02. The square of the relative diameter being taken instead of the mass, gives: Earth, 1; Jupiter, 4.35; Saturn, 0.92; Uranus, 0.05; Neptune, 0.02.

Applying the above given rule for eccentricity, and multiplying into these numbers, and also multiplying to make the earth the unit, we have:

Planet.	*On Mass*	*On Surface.*
Jupiter	1.255	0.479
Saturn	0.039	0.035
Uranus	0.0003	0.0004
Neptune	0.00001	0.00001

These figures show that, in the case most favorable to the theory, the increased effect due to Jupiter is only about one-fourth greater than that due to the earth, while the power of all the rest is insignificant in comparison. The effect due to the combined perihelion passages of the four greatest planets in the solar system is only about one-third greater than that produced by the earth at the beginning of each calendar year, when she is in perihelion.

The advocates of the perihelion theory may claim that this comparison is unfair, in two respects: First, that the cumulative force of these planets, acting through several years, will amount to much more than if it were operating only during the short time that the earth is nearest to the sun. Secondly, that the larger planets are confessedly much hotter than the earth, and therefore are capable of exerting a very much greater electric or thermal force per ton of matter, or per square yard of surface. Let us, then, take Jupiter as the unit of comparison. The above figures show that his power is increased by only one-thirtieth to one-fourteenth part, at most, by the adjuvant action of all the rest. We are, therefore, not warranted in believing that the combined perihelion passages will work more than three to seven per cent more of harm to the human race than is caused by Jupiter once in every twelve years, or a little less, when he makes his perihelion passage alone.

Of course, no one can assert, knowingly, that the black plague in Russia will not spread over other countries of the Old World or sweep this continent as with the besom of destruction. Such wide-spread devastation has occurred before, and will undoubtedly occur again, unless checked by scientific intervention, as history

always repeats itself. But the above considerations show that it would be entirely independent of perihelion passages.

We may add, in conclusion, that the perihelion passages referred to have not yet been made, and Jupiter, which is certainly the most potent of the lot, if there be any potency in the case, is yet fifty degrees from the perihelion point of his orbit; so that the present plague cannot be due to perihehia, unless we are prepared to admit that the effect may occur before the cause has an existence.

The phenomena, so full of terror to the many, will be welcomed by the astronomer. He will probably be able to find out more than is now known of these planets, especially in the case of Jupiter, whose perihelion passage will very nearly coincide with his opposition to the sun early in October, 1880. He will be pleased with the opportunity which is dreaded by those who, like the silly sheep in the fable, were

"Frightened at the sound
So sweet to huntsman, gentleman, and hound."

—*Our Rest.*

THE GREAT PYRAMID—ITS LOCATION AS RELATED TO SCIENCE.

REV. JAMES FRENCH, DENVER, COLORADO.

Once more we direct our thoughts to Egypt, the wonder land of the globe, whose history and surroundings are without a prototype and can have no reproduction; a kind of dreamland, whose objects and events seem isolated and shrouded in myth, and yet a land easily accessible and full of marvelous realities; the land of Ham, and the embryo cities founded by his son Misraim and his grandson Copt; the birth-land of history and civilization, where the arts and sciences were cradled and wrapped in their swaddling clothes of symbols and hieroglyphics; the land of hoary relics, strange and innumerable—of the pyramids, mausoleums, catacombs, mummies, temples, and obelisks. The land of Thebes with her hundred gates, and Memphis the home of the Pharaohs. The garden-land and granary of the old world, whose Goshen harvests sustained the famishing family of Jacob, and where his posterity, under the heat of privation and tyranny, on the anvil of slavery, were forged into a wonderful theocratic nation; the land upon the bosom of whose sacred Nile was launched that frail ark of rushes which was freighted with the prophet of their God, and their future liberator, lawgiver and judge. The land where, during the reigns of Shischank and Pharaoh Hophra, who were contemporaneous with Rehoboam and Jeremiah, profane and sacred history synchronized. The land where Herodotus, and Diodorus, and Strabo, and Tacitus wrote their histories, and where Plato, Solon, Lycurgus and Pythagoras obtained their education as teachers of philosophy and laws; the refuge of the world's Savior when he fled from the murderous hate of a deputy of the world's master;

a land terribly cursed by Mahommedan superstition, oppression and misrule, and governed by the basest of tyrants, as was distinctly decreed that it should be.

Oh, Egypt! Empress and yet slave! Once attired in robes of transcendent splendor, with pearls and diamonds glittering in thy crown, now sitting in the ashes of thy former glory, disowned, neglected and oppressed! Lift up thine eyes, thou despoiled and despondent queen, and catch that gleam of hope that comes piercing through the ages to thy relief from unfulfilled predictions as sure as those which doomed thee to thy present fate, which, when realized, will make thy throne and crown more glorious than ever.

But we must not linger amid the scenes and events that crowd upon us from every side and whisper from every object and strike us from every breeze, and that cluster around our memories as we stand in the silent and hallowed presence of Egypt's tombs of death and wonders of life.

We are here now, as before, for a special purpose. Our business is similar to that of the philosophers and students whom we quoted, who went there to take lessons in science. And there is one place in Egypt even now, while she is trampled under Mussulmen's feet, which is consecrated to this elevated purpose—one place which the polluted hands of Mahommedanism have not utterly destroyed—one place where we can, as Dr. Young puts it, "drink deep of the Pierian spring." That place is at the shrine of the Great Pyramid, where we have been lingering and learning.

There are peculiarities in the *location* of this massive pile which indicate its erection for scientific purposes, designed to be world-wide in its influences when its purposes become known.

I. *We notice the geographical peculiarities of its location.*

1st. It is at the southern apex of the fan-shaped Delta of the Nile, and therefore remarkably central for all of Egypt, and at the same time about equidistant from any part of the Egyptian coast on the Mediterranean Sea.

2d. It is at the center of the land portion of the globe.

3d. There is more land on the latitude of the Pyramid than on any other latitude on the earth.

4th. There is more land on the longitude of the Pyramid than on any other longitude on the earth.

These are strange facts, which we do not need to prove when we find them admitted by so able a writer as Richard A. Proctor in his elaborate criticism of "The Religion of the Great Pyramid." While he characterizes as fanciful the idea that these facts involve the necessity of superhuman guidance, he frankly admits that they point to the best location possible if designed for scientific purposes. This admission, it seems to us, is all we need; for if we were to prove Divine guidance in the selection of such a location, it could do no more than point to the best possible location. Does it weaken the basis of the inspiration theory that superhuman aid was not present when human aid was sufficient without it?

But suppose it was an additional design in the construction of this wonderful pile, that it should occupy a central position not only for Egypt's benefit but for the world's? That it is thus central, is admitted; and that this center was selected taking into account the Western hemisphere, then unknown, is an undisputed fact. On this hypothesis, is not the inspiration theory a consistent one?

There is one other significant peculiarity in this location viewed from a geographical standpoint:

5th. It is the key or connecting link between the continents of the Eastern hemisphere.

Especially is this the case now between Europe and Asia. So strategic is this location that, taken in connection with the vast granary afforded by the delta, it is a shining mark to attract the ambition of the ruling nations of Europe, where nothing can be done, looking to its occupation by any nation, without exciting the jealousy of others.

II. ***We notice the location of the Great Pyramid in its astronomical aspects; that is, so far as it affects the aspects of the heavens viewed from the pyramid as from an observatory.***

1st. It is at the 30th degree of north latitude, or very near it.

It is within one and one-third miles of the exact parallel of 30 degrees. It is between the exact 30th degree and the apparent 30th degree. Owing to the refractive power of the atmosphere, the apparent 30th degree lies about two and one-sixth miles south of the real 30th degree.

Much more importance is attached by Mr. Proctor to its position as viewed from its astronomical relations, than from those which are purely geographical. He says: "It would seem that the builders of the pyramid were anxious to place it in latitude 30° as closely as their means of observation permitted."

It would seem to us that the builders of the pyramid were anxious to place it n latitude 30° as near as the nature of the foundation on which it was to stand would permit.

Mr. Proctor's hypothesis involves an error in calculation of one and one-third miles, which, if corrected, would have placed the pyramid where it would have sunk and been destroyed ages ago. Is it not more reasonable to conclude that the latitude of 30° was known, and that it was built as near to that spot as possible, and at the same time have it stand where it would abide, on "the sure and proverbially wise foundation of a rock?" If the builder designed (as Mr. Proctor thinks he did) to put the structure on the 30th parallel *exactly*, he was not so wise as he has the credit of being; for to have placed it *exactly* on the 30th parallel would have "likened him unto the foolish man, who built his house upon the sand."

METHODS OF DETERMINING LATITUDE.—In explaining the manner of determining 30° latitude, Mr. Proctor is extremely happy, especially in illustrating the advantages of the stellar over the solar method. We will have him speak for himself. He says: "In our own time, of course, the astronomer has no

difficulty in determining with the greatest exactness the position of any given latitude-parallel. But at the time when the Great Pyramid was built it must have been a matter of very serious difficulty to determine the position of any required latitude-parallel, with a great degree of exactitude."

THE SUN METHOD.—"The most obvious way of dealing with the difficulty would have been by observing the length of shadows thrown by upright posts at noon in spring and autumn. In latitude 30° north, the sun at noon in spring (or, to speak precisely, on the day of the vernal equinox) is just twice as far from the horizon as he is from the point vertically overhead, and if a pointed post were set exactly upright at true noon (supposed to occur at the vernal or autumnal equinox), the shadow of the post would be exactly half as long as a line drawn from the top of the pole to the end of the shadow. But observations based on this principle would have presented many difficulties to the architects of the pyramid. The sun not being a point of light, but a globe, the shadow of a pointed rod does not end in a well defined point. The moment of true noon, which is not the same as ordinary or civil noon, never does agree exactly with the time of the vernal or autumnal equinox, and may be removed from it by any interval of time between zero and twelve hours. And there are many other circumstances which would lead astronomers like those who doubtless presided over the scientific preparations for building the Great Pyramid, to prefer a means of determining latitude depending on another principle."

THE STAR METHOD.—"The stellar heavens would afford practically unchanging indications for their purpose. The stars being all carried around the pole of the heavens, as if they were fixed points in the interior of a revolving sphere, it becomes possible to determine the position of the pole of the star-sphere, even though no bright, conspicuous star actually occupies that point. Any bright star close by the pole is seen to revolve in a very small circle whose center is the pole itself. Such a star is our present so-called pole-star and, though in the days when the Great Pyramid was built that star was not near the pole, another and probably a brighter star lay near enough to the pole to serve as a pole-star, and to indicate by its circling motion the position of the actual pole of the heavens. This was at that time, and for many subsequent centuries, the leading star of the great constellation called the Dragon.

"This star, called Thuban, from the Arabian *al-Thuban*, the Dragon, is now not very bright, being rated as barely above the fourth magnitude; but it was formerly the brightest star of the constellation, as its name indicates. Bayer also assigned to it the first letter of the Greek alphabet, though this is not absolutely decisive evidence that so late as his day it retained its superiority over the second magnitude of stars, to which Bayer assigned the second and third Greek letters."

"In the year 2790 B. C., or thereabouts, the star was at its nearest to the true north pole of the heavens, the diameter of the little circle in which it then moved being considerably less than one-fourth the apparent diameter of the moon. At that time the star must have seemed to all ordinary observation an absolutely ·:ed center, around which all the other stars moved.

"At the time when the pyramid was built, this star was about sixty times farther removed from the true pole, revolving in a circle whose apparent diameter was about seven times as great as the moon's. Yet it would still be regarded as a very useful pole-star, especially as there are very few conspicuous stars in the neighborhood.

"The pole of the heavens, we know, varies in position according to the latitude of the observer. At the north pole, it is exactly overhead. At the equator, the poles of the heavens are both on the horizon; and as the observer travels toward the north or south pole of the earth, the corresponding pole of the heavens rises higher and higher above the horizon. In latitude 30° north, or one-third of the way from the equator to the north pole, the pole of the heavens is raised one-third of the way from the horizon to the point vertically overhead, and when this is the case the observer knows that he is in latitude 30°. The builders of the Great Pyramid, with the almost constantly clear skies of Egypt, may reasonably be supposed to have adopted this means of determining the true position of that 30th parallel on which they appear to have designed to place the great building which they were about to erect.

"It so happens that we have the means of forming an opinion on the question whether they used one method or the other—whether they employed the sun or the stars to guide them in the geographical position they required. In fact, were it not for this circumstance, I should have thought it worth while to discuss the qualities of either method. It will presently be seen that the discussion bears importantly on the opinion we are to form of the skill and attainments of the pyramid architects.

"Every celestial object is apparently raised somewhat above its true position by the refractive powers of our atmosphere, being most raised when nearest the horizon, and least when nearest the point vertically overhead. This effect is indeed so marked on bodies close to the horizon that if the astronomers of the pyramid times had observed the sun, moon and stars attentively when so placed, they could not have failed to discover the peculiarity. Probably, however, though they noticed the time of rising and setting of the celestial bodies, they only made instrumental observations upon them when these bodies were high in the heavens, and so remained ignorant of the refractive powers of the air.

"Even that skillful astronomer, Hipparchus, who may be justly called the father of observational astronomy, overlooked this peculiarity, which Ptolemy would seem to have been the first to recognize.

"Now, if they had determined the position of the 30th parallel by observations of the noon-day sun (in spring or autumn), then, since owing to refraction they would have judged the sun to be higher than he really was, it follows that they would have supposed the latitude of any station from which they observed to be lower than it really was. For the lower the latitude the higher is the noon-day sun at any given season. Thus, when really in latitude 30°, they would have supposed themselves in a latitude lower than 30°, and would have traveled a lit-

tle farther north to find the proper place, as they would have supposed, for erecting the Great Pyramid .

"On the other hand, if they determined the place from observations of the movement of stars near the polar heavens, they would make an error of a precisely opposite nature. For the higher the latitude the higher is the pole of the heavens; and refraction, therefore, which apparently raises the pole of the heavens, gives to a station the appearance of being in a higher latitude than it really is, so that the observer would consider he was in latitude 30° north when in reality somewhat south of that latitude.

"We have only, then, to inquire whether the Great Pyramid was set north or south of latitude 30° to ascertain whether the pyramid architects observed the noonday sun or circumpolar stars to determine their latitude, always assuming (as we reasonably may) that those architects did propose to set the pyramid in that particular latitude, and that they were able to make very accurate observations of the apparent positions of the celestial bodies, but that they *were not acquainted with the refractive effects of the atmosphere.*

"The answer comes in no doubtful terms. The center of the Great Pyramid's base lies about one mile and a third south of the 30th parallel of latitude, and from this position the pole of the heavens, as raised by refraction, would appear to be very near indeed to the required position. In fact, if the pyramid had been set about half a mile still farther south, the pole would have seemed just right."

Mr. Proctor very readily concedes that, while he presents a possible way of locating the pyramid without any necessity of superhuman aid in doing so, this would not be likely to be accepted as a refutation of the inspiration theory. The point in the argument to which we attach the greatest importance is the agreement with regard to the facts which lie at the base of the whole discussion. But there is still another peculiarity in the location of the Great Pyramid, viewed from an astronomical standpoint, which we regard as worthy of consideration. It is as follows:

2d. The Great Pyramid was located where the distance through the earth, provided it were an exact sphere, of which the surface on that parallel was an arc, would equal, to approximate exactness, the earth's true polar diameter.

This is a remarkable discovery, made by Mr. Proctor in endeavoring to account for the admitted knowledge of the earth's polar diameter by the architect of the pyramid. He says:

"We may agree, in fine, with Smyth, that the builders of the pyramid knew the earth to be a globe; that they took for their measure of length the sacred cubit, which by *their* earth measures they made very fairly approximate to the 20,000,000th part of the earth's mean diameter, but there seems no reason whatever for supposing (even if the supposition were not antecedently of its very nature inadmissible) that they knew anything about the compression of the earth, or that

they had measured a degree of latitude in their own place with very wonderful accuracy."

He adds in a note:

"It may, perhaps, occur to the reader to inquire what diameter of the earth, supposed to be a perfect sphere, would be derived from a degree of latitude measured with absolute accuracy near latitude 30°. A degree of latitude measured in polar regions would indicate a diameter greater even than the equatorial; one measured in equatorial regions would indicate a diameter less even than the polar. Near latitude 30°, the measurement of a degree of latitude would indicate a diameter very nearly equal to the true polar diameter of the earth In fact, if it could be proved that the builders of the pyramid used for their unit of length an exact subdivision of the polar diameter, the inference would be that, while the coincidence itself was merely accidental, their measurement of a degree of latitude in their own country had been singularly accurate. By an approximate calculation I find that, taking the earth's compression at $\frac{1}{300}$ the diameter of the earth, estimated from the accurate measurement of a degree of latitude in the neighborhood of the Great Pyramid, would have made the sacred cubit—taken at one 20,000,000th of the diameter—equal to 24.98 British inches, a closer approximation than Prof. Smyth's to the estimated mean probable value of the sacred cubit."

Unbelievers in the inspiration theory will, of course, with Mr. Proctor, only regard this as another of the wonderful coincidences, or curiosities, abounding in this old rocky pile. But we see no objection to conceding that they might have found the polar diameter in this way, so long as they found it accurately. To us it is an additional marvel that such a measurement should so exactly correspond with the earth's real polar diameter. Is not this what might be called in court phrase cumulative evidence? To say of the wonderful coincidences abounding in the Great Pyramid that they are remarkable, or that they are curious, is, it seems to us, not at all responsive to the facts in the case. To us they are all this, and a great deal more. Like the successive steps of a theorem in geometry, the more one admits the more he must admit. Cumulative evidence we cannot resist, and if the earth's exact polar diameter, and sun's distance, and other facts of comparatively recent discovery are found built into its structure, we think consistency must compel us to withdraw from Copernicus and Kepler and Newton and others the credit history accords to them as discoverers, or admit that the architect of the Great Pyramid obtained his knowledge under Divine guidance.

METEOROLOGY.

THE MAY TORNADOES OF KANSAS AND MISSOURI.

BY PROF. JOHN D. PARKER, KANSAS CITY.

On May 30, 1879, occurred two of the most destructive tornadoes that were ever known to visit the Lower Missouri Valley. This statement is verified, whether we consider the violence of the tornadoes, the extent of territory passed over, the amount of property destroyed, the number of persons injured, or the loss of life.* The accompanying map gives the approximate paths of these tornadoes, which were raging at about the same time, and may have sprung from the same general disturbing causes. These two tornadoes we have named from the towns where they did the most damage, and will treat them as follows:

The Lee's Summit tornado seems to have originated near Belton, Cass county, Missouri. In the afternoon of May 30, 1879, there was a heavy shower at Belton, accompanied with hail, while further east another heavy storm was raging. Late in the afternoon these two storms seemed to unite to form the tornado, which passed off in a northeasterly direction. At Raymore, Cass county, several persons state that they saw the clouds gradually approach each other, forming two funnels in the air at the same time, which seemed to approach and play around each other, and then unite to form one mighty column, which swayed and rocked to and fro like a huge balloon, with the roaring and rushing of a thousand locomotives, as it passed on its way, leveling everything before it.

At Lee's Summit the people report the weather, on the afternoon of the 30th of May, as very sultry and oppressive, with a warm wind blowing from the south. Toward evening a cold current of air came down from the northwest, accompanied with hail and some rain. About six o'clock a black cloud from the southwest suddenly burst upon them, and the tornado swept by about two miles south of the town. A correspondent, who visited the path of the tornado, reports that everything in the shape of vegetable life was mowed clean, and the ground torn up in places, especially on hill-sides, as if hundreds of men with shovels had dug it up for a road-bed of some giant railroad. The largest trees were twisted off close to the ground like pipe-stems, or taken up by the roots and carried for hundreds of yards, and then dashed to the ground and splintered, in some cases, as fine as kindling wood. Ponderous rocks were hurled from their beds hundreds of yards

*I take pleasure in acknowledging my obligations to various persons for information furnished in reference to the May tornadoes, especially to Dr. F. A. Ballard and Mr. Charles H. Clark, of Independence, Missouri, and to Dr. Isaac B. Smith, of Frankfort, Kansas, and also to Miss Kate Slosson, a pupil of Mrs. Clara Hoffman, Principal of the Lathrop School, Kansas City, for assistance rendered in preparing the map for the engraver.

and broken into fragments. Buildings and fences were swept away and timbers carried in some instances over a mile and driven endwise several feet into the hard earth. Animals are reported as having been taken up and carried some distance, and let down uninjured.

The people at Blue Springs, about twelve miles northeast of Lee's Summit, liken the tornado to a huge tower of inky blackness reaching to the sky, preceded by a fearful rushing and roaring noise, the mass of the ascending column being perfectly opaque. Passing south of Blue Springs nothing could withstand the violence of the tornado, the most substantial houses in the vicinity of that place being swept away in a moment. Numerous instances are given showing the violence of the storm. The mold-board of a plow was wrenched off and carried some distance; a new wagon was wrecked, the spokes being wrenched from the hubs, and the tires bent into a variety of fantastic shapes. Trees were stripped of their bark and looked as if scorched, which phenomenon was

APPROXIMATE PATHS OF THE MAY TORNADOES.

first attributed to electricity, but afterward found to be a discoloration by a peculiarity of the sap. Prostrated trees were found lying some at right angles to the path of the tornado, and some pointing toward the vortex. Evidences are abundant that the funnel of the tornado contained a large amount of *debris*, and mud having a sulphurous odor, which was dashed with tremendous force and plastered over every obstacle remaining in the path of the tornado. A fence near Blue Springs, running east and west, was thrown down, the west end toward the south, the east end toward the north, showing the direction of the currents. A short distance beyond Blue Springs the tornado seemed to be lifted from the earth, not doing any more damage.

A correspondent, going from Blue Springs to Lee's Summit, says that for several miles the road runs along almost parallel with the track of the tornado, which was nowhere more than three hundred yards in width, and in some places was contracted to fifty yards. Some persons escaped who were caught in the tornado, although instantly blinded, stunned and covered with mud, and carried they knew not whither. The path of the tornado was deflected a little, about three miles southwest of Blue Springs. It seemed to sweep over hills and ridges and through ravines alike, carrying everything before it. It is impossible to give the mass of particulars gathered for this article, and many reports must be taken *cum grano salis*. Some four persons were reported killed, and a large number injured, some perhaps fatally. A correspondent traced the track of this tornado, giving range for the path examined of nine miles east and twenty-one miles north. The tornado passed along an elevated portion of the country, or a divide, the heads of streams along its course flowing from it both east and west. One of the U. S. Signal Corps observers, I learn, traced the path of this tornado back nearly to Paola, in Kansas.

The Irving tornado had its origin probably as far west as Ellsworth county, Kansas, and crossed the Saline river at the mouth of Twelve-Mile creek, where it did its first damage. It traveled in a northeast direction, through Lincoln, Ottawa, Clay, Riley, Marshall, Nemaha, and Brown counties, and passed into Richardson county, Nebraska. The same general storm touched Cawker City and Beloit, Mitchell county, Kansas, at about 2:30 p. m., unroofing at the latter place the tent of a circus which was in full blast, blowing down a number of houses, and twisting large trees in pieces as it passed down the Solomon river; this storm being, perhaps, an outlier or feeder of the main tornado. The Irving tornado passed about four miles south of Delphos, which has since been almost destroyed by another tornado, June 9, 1879.

After passing the Solomon river, the Irving tornado seemed to increase in violence and destructiveness. Some describe its appearance in its approach as "cloudy pillars" resembling smoke, afterward assuming an inky blackness, all rolling, dashing and clashing with each other, as if engaged in a furious battle. The tornado struck Stockdale, Riley county, doing some damage, whence it passed on, crossing the Blue river, lifting all the water out of the bed of the stream, and scooping the water, it is said, out of a well.

The people at Irving saw, just before 5 p. m., a dark mass of clouds gathering southeast of the town. A deep roar was heard, when the clouds began to lower and spin like a top, advancing upon the town and destroying one small house in the outskirts. This seemed to be a prelude, followed by a calm. Suddenly the heavens turned a greenish hue, and, with an awful roar, the tornado burst upon them, leaving the southern portion of the town a mass of ruins.

The tornado then swept onward, with a path from one-half to three-fourths of a mile in width, and when within two miles of Frankfort it passed up the west fork of the Vermillion river, in a north and northeast direction, a distance of fifteen miles, near Axtell, where it turned again upon its normal path and passed on near Sabetha. and into Richardson county, Nebraska. About fifty houses were blown down in the vicinity of Frankfort, and fifty families left destitute.

During the passage of the tornado neighboring towns received more or less damage. Vermillion suffered slightly, some of the houses being started from their foundations. Centralia, Blue Rapids and Waterville received some damage.

I give some singular incidents of the tornado, as related on good authority:

Mr. Fitch's son was blown across a ravine, over trees and fences, and landed unhurt on the door-step of a house half a mile distant. When asked how he came there, he replied, "I do not know!" Mr. Yawger found one of the wheels of his wagon 2½ miles from home. A tire was blown off a wagon wheel and straightened out as well as a blacksmith could do it. The body of a lady was driven into the ground head foremost, covering head and shoulders. A coat was torn from one man, divided in the center, the halves being driven in opposite directions. Some of the fowls were picked clean of their feathers. On Snipe creek, large elm, oak, walnut, cottonwood and sycamore trees were twisted off and torn up by the roots, leaving a fine forest a scene of desolation.

The number of killed and injured have been variously estimated. At Irving and vicinity, thirteen were killed and fifty wounded. At Frankfort and vicinity, five were killed and forty injured. At Delphos and other places large numbers are reported killed and injured. The people along the route of the tornado were engaged in little else for several days but in burying the dead and caring for the wounded.* In Marshall county alone the damage to property and crops is estimated at $150,000.

On May 29, 1879, occurred a destructive tornado in Andrew and Nodaway counties, Missouri. A correspondent says, on that calendar day, at Bolckow, Andrew county, a hot wind blew from the northwest for several hours. The skies had been overcast from early morning with clouds, which frayed off and separated into light-colored masses and drifted away, and finally dissolved in the atmosphere. About three o'clock clouds banked in the west and northwest in heavy black masses, and a current of hot air from the southwest appeared to hurl

* Immediately after the occurrence of the Irving tornado, Governor St. John issued a proclamation calling on the people of Kansas to render assistance to the sufferers, heading the subscription himself with a liberal contribution, and all has been done that is possible to relieve the sufferers.

them in wild wreaths like battle clouds on one another. About four o'clock the citizens were startled by seeing a wild funnel-shaped cloud appear in the west, and sweep onward as if to doom their town to destruction. Its muffled thunder roar was soon distinctly heard, and immediately it swept by the town upon its destructive mission. The track of the tornado lay about three miles northwest of the town, and presented the looped and ragged edge, so often seen in tornadoes, on the south side. Observers say the tornado at times seemed to stop and take a backward turn, and then sweep on with renewed force, making the loop in the sweep on the south edge. In this manner the tornado would destroy alternate pieces of property, leaving, perhaps, a house standing in the loop unscathed. The tornado passed about a mile north of Barnard, Nodaway county, and, when last observed, was moving toward Conception, Nodaway county. The violence of the tornado was very great; large trees, two and three feet in diameter, were twisted off, and the most substantial houses were lifted into the air and dashed in pieces. In one place it swept through a ravine, lifting out of its narrow walls every stick of timber, so that the bed of the ravine seemed to have been swept with fire. The northward tendency of this tornado in translation was probably due to surface currents.

Samuel W. Rhode, U. S. A., Sergeant of the Signal Corps, of Leavenworth, has kindly furnished notes, from the Journal of that station, on the storm of the 29th of May, which are as follows:

"This evening one of the most severe storms that has visited this section for several years past, passed over this station. During the afternoon the sky was partially, and sometimes fully, covered with heavy, cumulus-stratus cloud, moving rapidly from the southwest. The wind was blowing briskly from the south, with a low and steadily falling barometer and rising temperature. At 5 p. m. a heavy dark mass of 'thunder heads' appeared on the northwest horizon, and gradually moved eastward, increasing in bulk and extending toward the zenith. Frequently, during the formation and development of the storm cloud, as many as four different currents in the air were indicated by the movement of the clouds. The 'cyclone,' or spiral, motion of the wind was plainly discernable in the clouds for over an hour before the force of the storm was felt at the surface. Rain could be seen falling to the north of the station for ten minutes before there was any precipitation here. It looked like vast and dense volumes of fog impelled eastward at a high velocity. At 6:35 p. m. a few scattering drops of rain began to fall. At that time the heaviest portion of the cloud was directly north of the station, the apex being about 60° above the horizon, the wind blowing in fitful gusts from the south. At 6:58 p. m. the barometer reached its lowest point, the actual reading (corrected for temperature and instrumental error only) being 28.670. At 7 p. m. the wind suddenly backed from south to north and increased in force, blowing for about five minutes at the rate of sixty miles per hour. The cloud then moved rapidly southward, trending toward the east. The rain fell in perfect torrents for near an hour. From 7:10 to 7:40 p. m. considerable hail fell: a number of stones

were measured and averaged from $\frac{1}{4}$ to $\frac{3}{8}$ of an inch in diameter. The electrical discharges were very intense and almost constant. The force of the storm expended itself about 8:05 p. m. The rain cea ed at 8:15 p. m., and the amount which fell in one hour and forty minutes was one inch and forty-three one hundredths.

"The storm produced no serious damage in this city or vicinity. A large number of trees in the city were blown down, and several large buildings suffered damage by lifting of roofs. Fruit trees and growing grain were somewhat damaged by the hail. The position of fallen trees, in different portions of the city, plainly indicated the spiral motion of the wind. The large iron bridge over the Missouri river at this point, on which was a train of heavily laden cars, swayed so much that the engineer jumped from his engine, thinking the bridge was toppling over.

"At about the same hour, a very destructive tornado struck the earth north of this station, near St. Joseph, Missouri. No doubt the disturbance felt here was an offshoot of the above mentioned tornado.

"During the evening, from 9 to 11 p. m., the electrical display in the south, southeast and east was very beautiful and vivid. The heavens were almost continually illuminated. Frequently there were seen as high as a dozen streaks of lightning, of the zig-zag form, which seemed to radiate from a common center."

Several theories have been advanced in reference to the causes of tornadoes. In the present article I have only space to discuss one of them.

Storms are supposed to find their origin, according to the Thermal theory, in an unstable equilibrium of the atmosphere due to solar heat. About three-fourths of the sun's rays pass through the atmosphere, and are absorbed by the surface of the earth. The envelope of the earth is thus heated mainly at the bottom, while it loses most of its heat by radiation at the top. As an increase of heat diminishes the density of the air, the envelope of the earth is in a constant state of unstable equilibrium. The upper and heavier strata of the atmosphere tend constantly to descend and force up the lower strata. Vertical currents are thus formed over greater or less areas of the earth's surface by solar heat every day. The vapor contained in the air is thus carried up by the ascending current until it is condensed into cloud by the expansion and cooling of the air which contains it. The latent heat of the vapor thus liberated tends to elevate the temperature of the air containing it, causing it to be lifted to still higher altitudes. The violence of this upward movement is largely due to the amount of vapor, or the "steam power of the air."

The center, or core, of a storm sometimes becomes a tornado, which possesses a linear and gyratory movement. Connected with these there is a swaying movement, caused by obstacles, such as hills and forests, along the path of the storm, and sometimes the tornado seems to be drawn up into the air.

I have noticed quite a number of whirlwinds observing the laws of tornadoes. In 1872 I saw a beautiful whirlwind at Burlington, Kansas. While walking

toward the town from the northwest, I heard a rushing sound southwest of me. Soon I saw the prairie grass swaying violently, and I had a perfect view of a miniature tornado, as it passed across the road a few rods ahead of me. The atmosphere was tranquil at the time. Here was a whirlwind plowing its way through a tranquil atmosphere at the rate of ten miles an hour, moving east by twenty degrees north, and gyrating in a direction contrary to the hands of a watch.

Tornadoes in the northern hemisphere are translated toward the east by about twenty degrees north. Deflections from this direction are supposed to be occasioned by local causes, such as rivers, surface currents, etc. The Irving tornado was deflected from its path near Frankfort, passing up the west fork of the Vermillion river, in a north and northeast direction, a distance of fifteen miles, when it again resumed its normal path. North of the equator, tornadoes revolve in a direction contrary to the sun, or the hands of a watch with its face upward, while south of the equator they revolve in an opposite direction.

Tornadoes, according to this theory, originate in disturbing causes acting suddenly, but take their character from the cosmical conditions of the globe. The average temperature of the globe is about 85° at the equator, decreasing to about zero at the poles. This excess of heat expands the air in the equatorial regions, which flows over toward each pole. The larger portion of this circulation, however, is confined to a belt not extending beyond the thirtieth parallel of latitude, because the current is cooled in the upper regions, and the meridians narrow toward the poles.

As the atmosphere is carried around with the earth in its daily revolution, the greater the elevation the greater the velocity eastward. A stream descending from the upper regions of the atmosphere would be impelled by its inertia when it reached the earth in an eastward direction. As parallels of latitude decrease in diameter from the equator to the poles, every parallel, going from the equator, revolves with less velocity than the preceding one. Should a portion of the atmosphere become saturated and unduly heated at the surface of the earth, it would be forced up by colder and heavier air. Currents of air would be formed blowing toward a common center. In the northern hemisphere those from the north would naturally find the center moving eastward with a superior velocity, and, falling behind, be projected toward the west, while those from the south would find the center moving eastward with an inferior velocity, and be projected toward the east. The north half of the tornado would be impelled westward, and the south half eastward, establishing the whirl, or vortex which is a low barometer. The currents descending into the vortex on the south side having a greater impulse eastward, from the earth's rotation, than the impulse of the currents westward descending on the north side, the tornado would be deflected toward the northeast. The liberation of the latent heat by the condensation of the vapor, would be the "steam power of the air" to drive up the ascending current; large amounts of electricity would be developed for destructive purposes, and the tor-

nado would sweep on its path to overwhelm towns, crush forests, lick up rivers, and make the solid earth tremble.

The Thermal theory only uses heat, under cosmical conditions, as the *motive* power, leaving much of the phenomena to be accounted for by electricity and other destructive agencies.

Modesty should cover all theories of these awful but occult visitors like a garment A few golden threads are in our scientific fingers, but the theoretic fabric for tornadoes is still largely to be woven. Do not let us imitate that great German scholar who in his mature years found the works of his earlier life the hardest ones to answer.

There need not be any special alarm about tornadoes. Like great comets, they seldom appear, but on that account are the more noticeable. Destructive tornadoes only occur during dry seasons, and then, in this latitude, only on the last few days of May or on the first few days of June. The greatest tornado on record occurred June 3, 1860, the year of the drouth. It passed over a large portion of Iowa and Illinois, destroying Camanche, and killing fifty persons. That would not be an unusual railroad accident or ocean disaster. We stand a hundred chances of being killed in ordinary travel to one chance of being killed by a tornado. Still, we take our sleeping berth and fall into a quiet slumber. Tornadoes also occur just before evening, and, if we remember the law of their movement, we can generally escape them. Although, then, we may never be killed by a tornado, still it is always well to keep a clear conscience.

PARADOXICAL PHENOMENA IN ICE CAVES.

J. RITCHIE, JR., BOSTON, MASS.

The explanation of the phenomena peculiar to ice caves, for which a theory was advanced in the last number of the REVIEW, by Mr. N. M. Lowe, a Boston gentleman, and member of the Boston Scientific Society, has been a matter of interest to scientists for the past two centuries—an interest that may be considered as beginning with the publication of notices and theories in the *Memoires* of the Royal Academy of France, as early as 1699. The most complete and valuable work on the subject is that of the Rev. George Forrest Browne, entitled "Ice Caves of France and Switzerland," published by Longmans, and now out of print. The best informed of scientists, even, are not aware of the mass of matter that has been written and published on this subject, owing to its wide distribution through the proceedings of so many learned societies. The work of Mr. Browne is at once surprising, not only from the thoroughness with which he has studied his subject, but from the vast amount of labor undertaken by him, and the extent of his really valuable original investigation, carried on in a truly scientific manner, and including, as it does, the results of his personal exploration of a dozen of these

caverns. Having personally, and without a knowledge of the previous work of Mr. Browne, gone over a considerable portion of the references so well consulted by him, the credit due to that gentleman strikes us the more forcibly; but as our investigations have been with regard to the applicability of Mr. Lowe's theory, our own results may from time to time serve to throw a little more light on the subject.

The question of the temperature of ice caves, has ever been a bone of contention among observers, whole pages of the *Memoires* (1712) being used in the discussion of the results of another writer, by M. Billerez, whose own standard is itself vaguely rendered as *tres-grand froid;* and again, M. Boz, declares the caves to be warmer in summer than in winter. Lately, M. Thury, of the Academy of Geneva, in an account of a visit to the *glacieres* of the Jura and Vergy Mountains, (*Bib. Univ. Arch. Sci.*, 1861, p. 149), states that it is perfectly just to say that ice does not form there in winter, but rather in the fall, and, above all, in the spring, when the snow begins to melt. Mr. Browne, on the other hand, is inclined to reject the question of a winter thaw, so far as concerns the ice caves that he has visited, although the latter point is strongly held by the peasants, but at the same time cannot disbelieve the evidence brought forward to support the idea of a winter thaw in the other caves, which he had not as yet visited. Without attempting to discuss the matter of a complete disbelief of the statements of the country people when antagonistic to the opinion of an observing scientist, we will consider the thaw as out of the question in the caves visited by Mr. Browne, and, with the theory of Mr. Lowe, it makes but little difference whether this point is admitted or not, for it is only a side issue at most, but there still remain a number of caves where the winter's thaw may be considered as well as established.

In regard to theories, all scientists have not been as temperate as was M. Thury, who, in the same article as that above referred to, states the most important thing to be the collection of facts, Mr. Browne's work not having been published until some years later, and he hardly considered that there were enough collected to verify any theory whatsoever. The theory advanced by M. Billerez, Professor of the University of Besançon (*Memoires*, 1712), was based on the supposed action of nitrous salts in the earth above the cave, which, disintegrated by the heat of summer, were readily dissolved by the downward streams of water and in some way formed a freezing mixture. M. Boz, Royal Engineer (*Memoires*, 1726), melted ice to find the salts, and finding none, he disapproved of this theory, substituting instead a line of gorges contracting as they approached the mouth of the cave, and blowing into it the cold wind. M. Cossigny desired very much to connect with the phenomenon a *talus* of soft earth (*Memoires des Savants Etrangers*), which *talus* was considered by Mr. Browne to be the mud washed down a slope of snow by the rains. In 1789, M. Prevost considered the cave to be a natural ice house, owing to the non-conductibility of the material of which it was formed; and later, M. Cadet published an evaporating theory, in which the trees on the top of the hill, above the cave, played an important part; but, on the

authority of Mr. Browne, the circumstances upon which he based his theory were wanting. Prof. Pictet (*Bib. Univ.*, 1st ser., xx.) gives an account of a tour in the Jura Mountains, which has been translated and published in the *Edinburgh Philosophical Journal.* He attempted to account for the phenomena by a system of cold currents, producing evaporation; but his theory was combated and disproved the same year by M. Le Duc.

In reference to the cave of Illetzkaya-Zastchika, Sir John Herschel (1842) expressed his opinion that the evaporation theory was not a probable one, and substituted a wave theory, that seemed so unlikely that Sir Roderick Murchison, in his *Geology of Russia*, makes mention of it, but expresses himself of the opinion that it is not in accordance with the observed nature of the case. This theory, as well as that suggested by Prof. Piazzi Smith in the case of the ice cave in the peak of Teneriffe, was, briefly, that the winter's wave of cold would be retarded in its progress by the non-conducting power of the hillock in which the cave is situated, and would reach the cave in summer, and *vice versa.* It is curious, how so great a scientist should refer to so complex a cause phenomena which can be explained in a so much simpler manner. In regard to the cavern of Teneriffe, it lies at an elevation of 11,000 feet, and is, in consequence, not far below the level of perpetual snow. The circumstances here are favorable to the formation of ice by the process described by Mr. Lowe, the whole quantity of water and snow falling on its top being carried away by internal conduits, the sides of the mountain being free from the scoring produced by streams of water. The elevation and the low average temperature would seem, however, to admit of almost any desired explanation, whether of external temperature, non-conduction, or the effects of the previous winter's cold and ice.

The subject of ice caves had by this time excited considerable interest in this country, and at various times from 1838 to 1861, theories were suggested by various American scientists. Notices and discussions are scattered through the various issues of the *American Journal of Science and Arts* (Silliman's), but no distinct theory appears to have been given until that of Prof. Loomis, read before the American Society for the Advancement of Science, in 1860, but not appearing in its report, is probably not in print. A discussion of it may be found in *Hitchcock's Geology of Vermont* (i., 204), and it appears to have been that cold air has a tendency to descend; rivers or streams flowing through caves have a tendency to raise the temperature of the air, and the absence of these streams allows it to remain cold; hence the ice. This theory, which appears to have been quoted from memory, was disapproved of by Prof. Hitchcock, who declared that in that case all caves containing moisture and no running water would be ice caves. Hitchcock suggested an evaporation theory, but his main subject is rather a particular well in Brandon, Vt., and a peculiar phenomenon, rather than the general one of ice caves, and the larger portion of his arguments are for this reason special in their application.

[*To be Continued.*]

MINING NOTES.

RECENT FACTS FROM COLORADO.

BY JOHN K. HALLOWELL, ROSITA, COL.

(*Continued.*)

In the May number, by some mishap, I mentioned the "Maine" mine as being on the *north* foot-hill of Mount Tyndall, when it should have read *south* foot-hill. Approaching the foot-hill from the south side, the eye first catches a bold out-crop of rock on the southwest end, and about 200 feet above the gulch, and exposed from twenty-five to fifty feet above that point. The hill is about 250 feet high, and connected with Mount Tyndall to the east by a rising, curved slope. To the west it drops off quite rapidly to the level of the gulches that surround it on the three sides, viz.: south, west and north. On climbing to the rock out-crop, it is found to consist of an immense number of rounded boulders, bound together by an entirely different material acting as a cement, which appears to be mainly iron deposited from a water solution.

In the summer of 1877 Mr. E. C. Bassick, examining an old hole on an abandoned claim, found a small piece of horn-silver, and re-located the claim, commencing work at once near by, pay ore being found at the surface, which has continued down 240 feet with no present appearance of its giving out. The whole deposit consists of boulders of various sizes and surrounded with a scale of very rich pay mineral. The composition of the minerals is galena, zinc, tellurides, and free gold. The main shaft was put down 12x24 feet, and all was ore that was taken out, but the deposit enlarges as it goes down, and also increases in richness. Experts who have examined the mine estimate that there is left in sight more pay ore than has been taken out by four times. The value of the ore for the first year was considerably over $400,000. For the past year work in the mine proper has not been prosecuted very vigorously, but, nevertheless, a large amount of other work has been done, with a view to the future development and working of the mine. A tunnel has been run from the south side of the foot-hill and meets the main shaft at a depth of 180 feet. Here an engine room has been hollowed out of the rock, and most perfectly timbered, as well as the tunnel. This work having been completed in the last few weeks, a large force has been put on the mine proper, and work, by three shifts of men, pushed right along without intermission, and an immense amount of rich mineral is coming out. The zinc has some copper pyrites with it, and is very rich in gold. I saw one assay made that gave ninety-seven ounces, twenty-nine and a fraction of which were gold, the bal-

ance silver. The ore is all sorted before being shipped, and fifteen to twenty men are employed with small hammers, chipping the ore off the boulders and sacking the same for shipment to Denver, where it is treated at the reduction works managed by Prof. Hill. The formation and richness of this mine make it, without a doubt, the most remarkable on this continent. Rumor has had it for some time that the mine has been sold to Eastern capitalists for one and a half million dollars.

West of here, about three miles, a new discovery has been made, very similar in formation to the Maine mine, with the exception of the rich pay, but as it is only a prospect so far, it may by developing prove in time to be equally as good.

Coming back to Rosita, we find some of the older mines that first drew attention to this part of Colorado, situated on a continuous vein, viz.: the Virginia, the Humboldt, the Pocahontas, and the Southeast Leviathan. This vein was discovered on the 9th of April, 1874, and the first discovery, named the Humboldt, was sold for about twenty-five dollars' worth of pork and flour. At a depth of fourteen feet, one-half sold for one hundred dollars, and at one hundred feet depth one-eighth sold for five thousand dollars, and in September, 1875, one-half sold for thirty-two thousand dollars cash, the claim passing into the hands of the Humboldt Silver Mining Company, who also purchased the South Humboldt and West Virginia claims. In connection with this mining enterprise, the Pennsylvania Reduction Works were built for the purpose of reducing the ore produced, and afterward the capacity of the works was doubled, that the company might also do custom work for other mines. However, most of the ores produced not being adap ed to their method of reduction—viz., chlorination and amalgamation—and their own mines having been worked down to a fault in the vein, so that comparatively little ore was produced, a few weeks ago the works were shut down, until leased by the Silver Cliff Milling Company, who had the misfortune to lose their own plant at Silver Cliff by fire.

The product of the Southeast Leviathan up to January 1, 1878, was $4,300, value per ton, $86; of the Pocahontas to same date, $317,477.51, value per ton, $124; the Humboldt, $225,604.15, value per ton, $107; the Virginia, $18,-547.85. Total, $565,929.51. Since January 1, 1878, the out-put from these mines has been comparatively meager, the Humboldt and Virginia mines having worked into a fault, and the Pocahontas into a lawsuit. I cannot say which is the worst, but all are in the same category so far as products are concerned. The Humboldt, however, is putting up machinery and building over another shaft on their vein, where they have had pay mineral from the surface. To the admirable report of Prof. R. Neilson Clark, I am indebted for all of the foregoing facts and statistics.

Of recent discoveries, the Leavenworth has worked into a fine body of pay ore, milling 160 ounces per ton, and been sold at what the owners consider a profitable figure, I presume. The Custer County Tunnel Company, after drift-

ing through 300 feet of the hardest kind of rock, on the south side of Robinson Hill, came into a vein of mineral that assayed, to start with, 168, 198, and 333 ounces of silver; this at a depth of about 2 ;o feet from the surface. Added to these, must be g.ven the most recent big strike, one mile northeast of Rosita, adjoining the granite formation, of horn-silver, four feet from the surface, an assay of which I saw weighed at the rate of 4,260 ounces per ton. But the big assay of all came from Silver Hill, ten miles east of here; a small piece of quartz float, showing free gold, gave over $200,000 per ton. For two or three years similar pieces have been found in that neighborhood, but up to date the lode from which they have come has not been discovered. Its being found, however, is only a question of time, as somewhere in the neighborhood it must be.

From the foregoing facts given, I think you will agree with me when I state that this part of Custer county compares favorably with any other part of Colorado, for the length of time that its mines have been worked, and considering that they never had the advantage of outside capital that recent mining camps have got, all that has been done being the result of hard, steady work; and the total value of the out-put up to date must reach near one and a half million dollars.

That there are many more and perhaps richer mines to be developed in this immediate neighborhood, I am confident; and, so believing, I have stuck my stakes here, hoping, by a requisite amount of pluck, energy and hard work, to be one of those who will be successful in helping to find them.

Some weeks ago I heard a railroad man say that, by climbing any of the water tanks along the western end of the Atchison, Topeka & Santa Fe Railroad, as far as the eye could reach, covered wagons would be in sight, within hailing distance of each other, *en route* for Colorado. Within the past ten days the advance guard of "prairie schooners" has arrived here, and every good gulch and spring in this vicinity has more or less campers. I trust the idea is not prevalent among them, as it is with some I have conversed with who came through by rail, and were disappointed that they could not walk up to the nearest hill, fill their carpet-sacks with silver bricks, and go home to spend the rest of their days without further toil or care. Well, they generally go home fully as soon as they contemplated, but the material for the silver bricks stays here, for all they do to obtain it. Mining is a business, and should be entered into the same as any other pursuit; but it will take labor, knowledge, judgment and capital to make a profit from it, and, while the individual investment may be very small in proportion to the profitable returns, the aggregate investment may be more likened to the oil well investments, which at one time, I heard a competent authority estimate, did not pay one-half of one per cent on the total sum expended.

General Tannatt estimates the accessions to the population of Colorado at 490 per day, average. For the year that would give a total of nearly 179,000. Verily we must make arrangements for another representative in Congress, and begin to put on airs.

THE SILVER MINES OF SOUTHEAST MISSOURI.

Hon B. B. Cahoon of Fredericktown Mo., states in an interview reported in the *Plaindealer* that the silver mines of southeast Missouri will soon give to region unprecedented prosperity. He states that one silver mine (that at Silver Mountain) has already been sufficiently opened, by following beneath the rocky surface a true fissure vein of argentiferous galena, bearing silver yielding from fifteen to ninety ounces of silver bullion to the ton of ore, from which, even now, when it is not yet fully opened, over one hundred tons of this ore can be taken out crushed, cleaned and dressed every day, at but a nominal figure, not exceeding eight dollars per ton, which will yield a net profit of at least fifty dollars to the ton. This is the situation of this mine in its infancy. I believe that vein goes to the center of the earth, and becomes richer the further it is followed. Already the company operating this mine have over five thousand tons of this ore out, and its yield from the surface was such that the ore now out will more than pay for opening the mine, erecting the present works, improvements, etc., now nearly ready to begin the crushing and smelting of the ore, and which, experts inform me, are cheap if they have not cost no more than $175,000. So much for what we can see. Any person aquainted with the geological characteristics of the volcanic region bordering upon the St. Francois and Castor rivers, and who has given attention to the matter of what rocks are necessary to be in juxtaposition to bear silver, must be convinced that the granite and porphyry formation, interspersed as it is with veins of quartz, which lines these rivers and the territory adjacent to them, as it runs from the lower part of St. Francois county through Madison, Wayne and Reynolds counties, are silver bearing and that is not too sanguine to believe that this silver found and already exposed at the Silver Mountain, is but the outcropping of the same true fissure vein, which permeates those regions. I am convinced that a very few years (may be but a few months) will demonstrate that we have silver in as profitable quantities as is to be found in Colorado.

Fairplay *Flume*: "Several large transfers of Summit county placer claims have been made during the winter and one or more quite recently, and everything seems to indicate a prosperous mining season there. So many prospectors are diverging from Leadville to all adjacent points that this county is sure to be thoroughly gone over for lead mines as well as placer. We believe that when 'proved up' by systematic work, not Ten Mile alone, but many parts of Summit county will open as fine mines as any in the State. It would be strange indeed if such an interval of barren hills should interpose between the rich districts of Boulder, Gilpin and Clear Counties on the north and Lake and Park counties on the south, especially with its wealth of gulch gold already proven."

SCIENTIFIC MISCELLANY.

BARFF'S NEW PROCESS FOR PRESERVING IRON.

Professor Barff lately gave a lecture in London on the results obtained by his new process since its first announcement, about two years ago, an account of which was then published in the *Scientific American.*

The process consists, in brief, in subjecting the surface of the iron to the action of super-heated steam at a high temperature. The result is the production upon the surface of the iron of a hard, smooth and durable skin of black oxide of iron, which prevents rust far better than any paint, lacquer, rubber, or other compound or process heretofore known.

Iron articles to be treated by this new process are first cleaned with dilute sulphuric acid, and afterward with bran water. They are then placed within a muffle, the temperature of which is 500° or 600° Fah.; dry super-heated steam at a temperature of 1,00_° Fah. is admitted, atmospheric air being carefully excluded. The formation of the black oxide skin rapidly takes place.

This coating has peculiar properties. It is so hard that it resists emery powder and the file. Many substances which adhere to ordinary iron will not stick to this prepared iron. For cookery the new process is especially useful. Barff stew-pans and other utensils are more cleanly, as arrowroot and other substances can be cooked in them and the vessel cleaned with great ease. Barff vessels can be heated red hot without injuring the skin. Barffed iron is proof against damp, water, hot or cold, and stands exposure to the weather far better than galvanized or painted iron. Barffed boiler and ship plates, whether of iron or steel, are superior to all others, as they do not corrode, and sediment does not readily adhere. The process is applicable to almost every conceivable form of iron manufacture, and appears to be a scientific, important and valuable contribution to the industrial wants of the world.—*Scientific American.*

WHEN the excavations at Olympia were first undertaken, the German Postmaster-General, Dr. Stephen, drew attention to a passage in Pausanias' description of Greece, in which he mentioned a statue that had been erected in honor of a courier of Alexander the Great, and begged that special search might be made for it. News has just reached Berlin from Olympia that the base of this statue has been found, with a well preserved inscription which runs thus: "To the King Alexander's Runner and Traverser of Asia, Philonides, son of Totos, from Kretan Chersonesos, this was dedicated for the Olympian God."

BOOK NOTICES.

THE GEOLOGICAL RECORD FOR 1876; Edited by Wm Whitaker, B. A., F. G. S., of the Geological Survey of England; pp 415, octavo, London: Taylor and Francis, 1878.

This is an account of works of Geology, Mineralogy Palæontology, published during the year of 1876, and is the third of a series commenced in 1874. The volume is divided into stati-graphical and descriptive geology; Physical Geology, Applied and Economical Geology, Petrology, Mineralogy and Palæontology, each of which divisions have been made up by competent sub-editors, such as Messrs Tapley, Lebour, Drew, Tawney, Etheridge, Bonney, Rudler, Miall, Nicholson, Carruthers, Woodward and Dalton. The works consulted number hundreds, and the information derived from them has been condensed to the greatest advantage. As a book of reference to students and amateurs there can be nothing more useful and convenient, since geological works and magazines from every country on the globe are represented and referred to in it, and of course scarcely any single point of interest left unnoticed.

HEARING, AND HOW TO KEEP IT. by Chas. H. Barnett, M. D. 12mo pp 160; 50c.
LONG LIFE, AND HOW TO REACH IT. by Jos. G. Richardson, M. D. 12mo. pp 160, 50c.

These are the first and second volumes of the American Health Primers, announced in the June REVIEW as about to be put forth by Lindsay and Blakiston of Philadelphia, and are well worth careful perusal by all interested, (and their name is legion). Written by eminent and able writers, the respective subjects are discussed in a familiar and common sense manner that will render them especially popular, while the titles alone will attract readers from all classes. The "ounce of prevention," as well as the "pound of cure," is well put forward in both books and the rules of action are so plain and simple that it seems easier and more natural to follow than to disregard them. No purchaser of these or the succeeding volumes of the series will regret it.

HAECKEL'S GENESIS OF MAN. By Lester F. Ward, A. M. pp 64, octavo.

Professor Haeckel, in his late work, "The Evolution of man," of which the pamphlet above named is a condensed exposition, gives the latest doctrines of the

Continental school of evolution in its application to the history of man, and Prof. Ward unquestionably reproduces very closely the position and views of the great German naturalist and philosopher; so that to those desiring to obtain in brief an understanding of these views and beliefs without being at the expense of buying the work itself, now advertised by the Appletons, and the subsequent trouble of following out the argument of the author, this little *brochure* will be of great service.

EDITORIAL NOTES.

WE issue the July number of the REVIEW a few days in advance, in order that our readers may have the benefit of Professor Pritchett's interesting article on "The Conjunction of Mars and Saturn" in time to make such observations of the phenomena described as they may desire and have the facilities for, on the mornings of June 29th and 30th and July 1st. As suggested by Prof. Pritchett, it will pay to lose an hour's sleep on those mornings for the sake of witnessing so rare a spectacle.

THE Missouri Press Asscoiation held its annual session at Columbia on the 27th and 28th of May, and the meeting was largely attended by the fraternity. Its exercises were very interesting, but, as they have been made public by every daily and weekly paper in the State long since, we will only remark that these meetings are being better managed and are becoming more important with each succeeding year, and that the essays, orations, poems and papers presented and read were, in many respects, superior to those of previous sessions.

Of the people of Columbia, who are so constantly and continuously called upon for the exercise of hospitality, by reason of the numerous visitors to the various institutions of learning located there, it is but little to say that they were untiring in their efforts to make our visit pleasant, and that they succeeded in the fullest measure. Our personal thanks are due to the family of our old friend and fellow curator of the University, R. L. Todd, Esq., for intellectual, æsthetic and gastronomic entertainment of the most excellent quality, and to Professor Swallow for an invitation to examine the largest and finest geological and mineralogical cabinet in the West, one to whose collection and arrangement he has devoted the greater portion of a studious and laborious life.

The importance and value of the Missouri University has not been adequately understood even in our own State, notwithstanding the able and vigorous efforts of its Faculty and of such effective co-workers as Major Rollins, Col. Switzler and others who have taken a life-long interest in its welfare; but, doubtless, from this time on, when the question of abundantly sustaining the University shall arise in the Legislature, the press of the State will be found ably and intelligently advocating liberality in appropriating money in its behalf.

Of the excursion to Toledo, Detroit and Put-in-Bay Island, nothing remains for us to say except to express our personal obligations to the officers of the North Missouri, Wabash, Michigan Southern, Michigan Central, and Chicago & Alton railroads for unremitting courtesies at all times, to the members of the press at Toledo and Detroit for overwhelming attentions, and to Capt. J. H. Turner, President of the Missouri Press Association, for his excellent management which made the whole affair a perfect success.

ON account of absence from the city on the occasion of the annual meeting of the Kansas

City Academy of Science, May 27th, we were unable to attend that meeting; but from the reports of it in the daily papers and the statements of those present, we learn that it was well attended and, that the address of Rev. Dr. Marvin was a valuable, interesting and scholarly effort.

The former officers were reëlected, except that Prof. J. D. Parker was elected Recording Secretary in place of E. D. Phillips, Esq., and H. P. Child was made Curator and Librarian in place of Harvey West, who has left the city.

THE tornadoes of the 29th and 30th of May are fully described and discussed in this number of the REVIEW by Professor Parker, to we call especial attention as giving a clear exposition of the Thermal theory on the origin and nature of such phenomena.

THE War Department is considering the question of removing the United States Signal Service station from Leavenworth to this city, for the reason that the facilities for rapidly distributing the Daily Bulletins over a much larger district are far superior here, while the conditions for properly observing meteorological phenomena are alike at both places.

PROFESSOR NORDENSKJOLD has solved a long pending geographical problem by sailing the *Vega* through the Arctic Sea, to the north of Siberia and *via* Behring's Straits, from Europe to Asia. Whether this discovery will ever be of any great commercial value to the world, is doubtful, but the daring feat places his name side by side with those of the most noted navigators of the world.

OUR young friend R. W. E. Twitchell, of this city, quite distinguished himself by an address at the commencement exercises of the Kansas University, upon the subject of The Development of the Race, which has been highly commended by excellent judges.

CYRUS H. MCCORMICK, of Chicago, has become corresponding member of the French Academy of Sciences by unanimous invitation of that body, extended to him upon the death of M. Chevandier de Valdrome, last month. The membership of the Academy of Sciences is limited to eight resident and eight corresponding members.

THE great meteor, weighing 431 pounds, and measuring 2 feet long by 1½ wide, which fell at Estherville, Iowa, May 10th, is to be sent to Chicago for exhibition. It is composed, apparently, of nearly pure metal, of which a finger ring has been made, resembling silver in appearance.

THE twenty-eighth meeting of the American Association for the Advancement of Science will be held at Saratoga, New York, commencing August 27, 1879.

The hotels and railroads will make the usual concessions on rates, and the local committees will do everything in their power to make the meeting pleasant to those attending. For special information, addsess Local Corresponding Secretary, P. O. Box 1071, Saratoga, New York.

The headquarters of the Association will be at the United States Hotel, where the members will report and register. All fees and papers for reading and publication should be sent to the Permanent Corresponding Secretary, Prof. F. W. Putnam, at Salem, Mass., up to August 22d.

THE Missouri newspapers are full of eulogistic notices of the handsome treatment received by them at Columbia, Toledo and Detroit, as well as by the railroad men all along the line.

THE Woodruff Scientific Expedition around the world has been abandoned, and its projector has since died. His death is largely caused, it is said, by the failure of an enterprise in which he had embarked with great zeal and ardor, believing it to be a means of doing great good to his fellow citizens, and in which he had not hesitated to invest all his means.

THE preservation of railroad ties is a matter which must sooner or later engage the atten-

tion of railroad men in this country, as it already has abroad. Germany has taken the lead in experiments of this sort, and the ties on fully half the miles of road in the empire are now impregnated with various chemical solutions. Chloride of zinc appears to be the most satisfactory thing tried, and its use increases the life of ties from 40 to 60 per cent for oak, 60 to 100 for pine 100 to 130 for fir, and 400 to 500 for beech. The cost of treating is six to nine cents per tie for oak, eight to twelve for fir and twelve to twenty for beech, and the increase in length of service, which has averaged fourteen years for pine ties, more than makes up for the expense. As the consumption of ties in the United States is constantly increasing and the area of forests decreasing, our railroads will ultimately have to follow this example or adopt some other material for ties.

GOLD has been discovered in the quartz reefs of the Wynadd district of the Madras Presidency, East India.

NEAR Hamilton, on Tarryall creek, in Colorado, veins of good coal are said to have been discovered seven to eight feet in thickness, which, according to an analysis made by Prof. E. T Cox, State Geologist of Indiana, furnish coke 57.58, volatile matter, 42.42. Being near the present terminus of the Denver & South Park Railroad, this discovery seems to be of great importance.

COLUMBUS, Georgia has been called the "Lowell of the South." It has eight cotton mills besides many other manufactories. The water power at this point is unrivaled. There is a fall of one hundred and forty-seven feet in the river at Columbus, extending for three miles above. This furnishes forty thousand horse power for future use, not including what hasa lready been utilized. The Chattahoochee river is about the size of the Connecticut. There are now in operation here on the river five large cotton mills. Three of these mills are controlled by one company. The three mills run 16,000 looms and 45,000 spindles. They consume about 18,000 bales of cotton annually. Columbus has $3,000,000 invested in cotton manufacturing.

CURRENT LITERATURE.

Through the kindness of Professor William Crookes, F. R. S., etc., London, we have received the advance sheets of his lecture on "Molecular Physics in High Vacua," delivered at the Royal Institution, April 4, 1879. As this article would occupy nearly one-half of a single number of the REVIEW, and involve an expenditure of not less than one hundred dollars for the electrotypes necessary to illustrate it, we are unable to reprint it; but, in view of its transcendent interest and the simplification of its seeming obscurities by means of the beautiful illustrations and the distinguished author's remarkable faculty of explanation, we advise all interested to purchase the June number of the London *Monthly Journal of Science*, and enjoy a rare treat.

MR. GEO. R. TWEEDIE, in the London *Chemical News* for May 15th, describes a new method of producing a coating of magetic oxide on iron surfaces, by first heating the articles and then acting upon them for a certain period by the products of combustion largely mixed with air from a peculiarly constructed furnace, after which a stream of carbonic acid oxide is passed over them for a short time, changing the red oxide to magnetic oxide, which withstands all ordinary oxidizing influences perfectly.

WE learn from the *Engineering and Mining Journal* that the Bessemer medal was awarded, at the late meeting of the Iron and Steel Institute, in London, to the venerable Peter Cooper, of New York, as "the Father of the iron trade of America."

DR. H. C. CHAPMAN reports, in the *Proceedings* of the Academy of Natural Sciences of Philadelphia, for the first quarter of 1879, the dissection of a female chimpanzee five years old, with the following results: The muscular, vascular, alimentary, respiratory, and circulatory systems differ but slightly from

those of man. In the brain "all of the convolutions and fissures described in the human brain can be identified," and "that on the whole the gap between the brain of the chimpanzee and man is less than that between the chimpanzee and the lower monkeys, and that the brain of the chimpanzee resembles that of man quite as closely as that of the orang."

PROF. O. C. MARSH, in his article on Polydactyle Horses, in the *American Journal of Arts and Sciences* for June, describes a number of horses of modern days with one, two, three or more extra toes or digits. One in particular was on exhibition in New Haven a few weeks since, which had an extra digit on the inside of each foot, with a hoof upon it just like that upon the foot itself, except that it was smaller.

THE rejoinder of Prof. Simon Newcomb, in the *North American Review* for June, to the four distinguished theologians who discussed the question of Law or Design? in the May number of that magazine, cannot, in our opinion, be regarded as in any degree settling the controversy, since it is mainly devoted to discussing the positions of the others instead of sustaining the postulate put forth by himself as a basis of debate; and his sole conclusion is the doctrine that "Nature has always been what we see it now;" that "there is neither more nor less of design in any one process of nature than another;" that the creative power "was never exerted in any more striking manner than it is exerted before our eyes at the present time;" that "the creation of all living beings, and their adaptation to the conditions which surround them, are results of a process which we see going on around us every day," and, finally, that the basis of nature is "involved in mystery in every direction," that the "scientist studies it simply to understand the relation of its phenomena," leaving "everything which lies behind or above this fcr investigation by other methods than those with which he is conversant."

Van Nostrand's Engineering Magazine for June has a most interesting and valuable article by Sir Wm. Thomson, F. R. S. E., F. C. S., upon the Injurious effects of the air of large Towns on Animal and Vegetable Life, and methods for securing salubrious air.

PROFESSOR J. BALL, who has been engaged in scientific researches in Texas for several years past, contributes an article to the *American Naturalist* for June, upon the Geognostic and Agricultural Aspects of that State, which will prove of decided value to all persons intending to remove thither, and to such we confidently recommend it.

FOR reliable and valuable scientific information with regard to the ore formations of Leadville and vicinity, probably nothing can exceed the articles of Prof. Carl Henrich in the New York *Engineering and Mining Journal.* They are the work of an accomplished geologist and engineer and are fully illustrated with sectional drawings of the different mines of the locality.

WE find in the *Hartford Daily Times* an Abstract of a Lecture on the Chemistry of Artists' colors, by Prof. H. C. Bolton, which contains many facts of interest to popular as well as scientific readers, relative to the history of the painters' art and the importance of a knowledge of chemistry in the mixing of colors, &c.

Harper's Weekly states that "saucissenkartoffelbruchsauerkranzwuurst" is a favorite German dish, and adds that a railroad traveler who had "five minutes for refreshments" undertook to call for a plate of "saucissenkartoffelbruchsauerkrautkranzwuurst," and the train was at the next station, twenty miles distant, before he had half finished asking for the dish.

THE *La Plata Miner*, published at Silverton, Col., says: San Juan has abundance of carbonate ore. On the head of the Dolores there are a dozen good carbonate mines already being worked. On the Howard Fork there are several mines which carry

carbonates that will compare favorably with the very best mines at Leadville, and they have the advantage over Leadville of being well defined veins. A discovery was made of a carbonate lode of twenty feet in width on the Howard Fork this week. Assays from the surface show twenty to forty ounces in silver to the ton.

Harper's Magazine for July presents the following attractive table of contents: Narragansett Pier, Prof Charles Carroll, with fifteen illustrations; The Owl Critic, a poem, James T. Fields, with two illustrations; The Land o' Burns, William H. Rideing, with fifteen illustrations; The Mowing, a poem, S. H. M. Byers, with one illustration; A Peninsular Canaan, III. Delaware, Howard Pile, with nineteen illustrations; The Happy Island, a story, Edward Everett Hale; A Romance of Easthampton, A. A. Hayes, Jr., with three illustrations; The Storming of Stony Point, H. P. Johnston, with three illustrations; Fifty Years of American Art, I., S. G. W. Benjamin, with thirteen illustrations; Young Mrs. Jardine, Dinah M. Craik, with three illustrations; Recollections of Charles Sumner, E. P. Whipple; The Diary of a Man of Fifty, a story, Henry James, Jr.; Editor's Easy Chair; Editor's Literary Record; Editor's Scientific Record—Astronomy, Physics, Anthropology, Zoölogy, Engineering and Mechanics; Editor's Historical Record.

The following are the contents of the *Atlantic Monthly* for July: Massy Sprague's Daughter; Glamour, William O. Bates; Public Balls in New York; The People for Whom Shakespeare Wrote, II., Charles Dudley Warner; Recent Modifications in Sanitary Drainage, George E. Waring, Jr.; Juno Ludovisi, Hjalmar Hjorth Boyesen; Irene the Missionary, XIV.-XVIII.; The Morning Hills, Maurice Thompson; Our Commerce with Cuba, Porto Rico, and Mexico, C. C. Andrews; The Children Out-of-Doors, John James Piatt; A Fossil from the Tertiary, Edward E. Hale; Avalanches, H. H.; English Skies, Richard Grant White; The Contributor's Club; Recent Literature; Education.

The contents of the *Popular Science Monthly* for June are as follows: Condition of Women from a Zoölogical Point of View, I., by Prof. W. K. Brooks; Selecting a First Meridian, by E. Cortambert (illustrated); The Study of Physics in the Secondary Schools, by John Trowbridge; Modorn Science in its Relation to Literature, by William Brackett; Observations on the Chameleon, by O. R. Bacheler, M. D.; The United States Life-Saving Service, by W. D. O'Connor (illustrated); Diseased Condition of the Faculty of Wonder, by Professor Gairdner; Are Explosions in Coal Mines Preventable? by Francis R. Conder, C. E.; Chemistry in its Relations to Medicine, by Professor Ira Remsen; The History of Games, by Edward B. Taylor, F. R. S.; Whales and their Neighbors, by Dr. Andrew Wilson; A Problem in Human Evolution, by Professor Grant Allen; Sketch of Professor Clifford (with portrait); Correspondence; Editor's Table; Literary Notices; Popular Miscellany; Notes.

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KANSAS CITY

REVIEW OF SCIENCE AND INDUSTRY,

A MONTHLY RECORD OF PROGRESS IN

SCIENCE, MECHANIC ARTS AND LITERATURE.

VOL. III. AUGUST, 1879. NO. 4.

ARCHÆOLOGY.

ARCHÆOLOGICAL EXPLORATIONS IN TENNESSEE.

BY PROF. F. W. PUTNAM, PEABODY MUSEUM.

(*Continued.*)

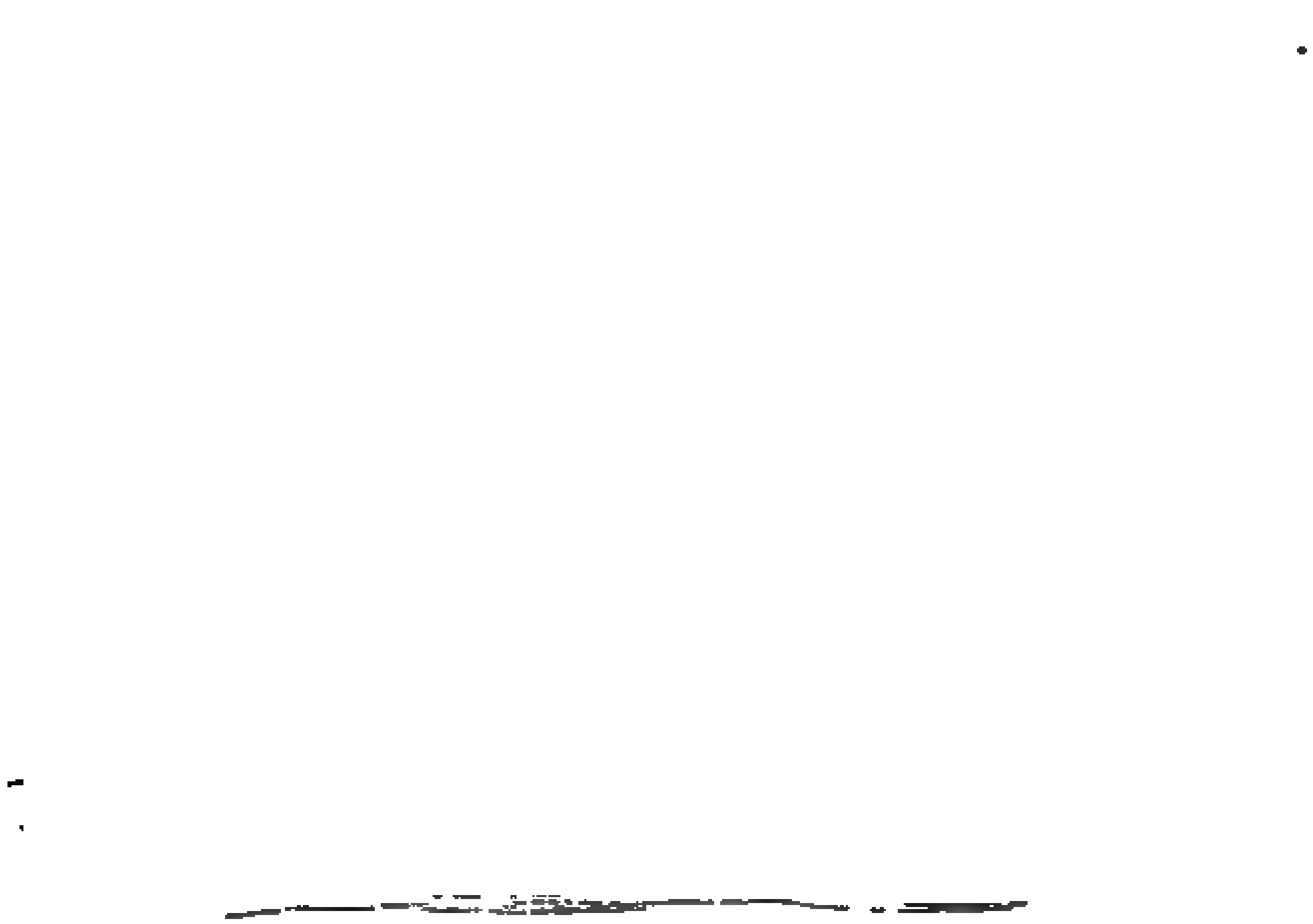
Of articles made of shells, several forms occurred in the graves in this mound, the most common being the spoons made of the valves of the *Unio*. These spoons, as will be seen by the illustration (Fig. 30), were very convenient and useful domestic articles. Many of them were found in the graves, and generally in such vessels as food would naturally be placed in, but owing to the decay of the thin shell, few could be handled without crumbling into chalky particles. Six were, however, saved from the graves in mound 1, and several others were collected afterward in different localities. All of those from the graves in the mound were made from the right valves of the mussels, and indicate right-handedness, as the rule, with this people.* They were made by cutting away the thick portion of the shell along the hinge, and also the thin portion of the lip. The shell was then further cut away on its upper part, leaving the projecting handle as shown in the figure, which, from the position in which the spoon was placed by the artist, does not convey as good an idea of the thing itself as would be the case if the drawing had been reversed, and the handle part of the spoon placed in the right

* I have since examined over thirty of these shell spoons, now in the Museum, and all are made from the right valves of *Unionidæ*, and so shaped as to be most conveniently used with the right hand.

hand lower corner. This would bring the valve of the shell in its natural position. and also show the spoon in its most convenient position for use in the right hand. In some specimens the handle is not rounded and smoothly cut, as in the one figured, but is deeply notched on its outer edge as if for ornament.

Many natural valves of several species of *Unionidæ* were found in the graves, sometimes in the same grave with one or more spoons. Several other shells in natural condition were also found in the graves. The most numerous of these were two specimens of *Melania*, and one or two other specimens of fluviatile shells common in the State, and, of course, they must have been purposely deposited within the graves, while several specimens of *Helix* were undoubtedly living intruders.

Fig. 30.



Spoon made from Shell of Unio, Stone-grave Mound. Natural size.

In one grave, near the head, were several hundred specimens (11934) of the little *Olivella*, identified by Prof. Hamlin, of the Zoölogical Museum, as *O. mutica* Say, of the Southern Atlantic coast. Every one of these little shells, which are not much over a quarter of an inch in length, has the apex ground off, thus making a hole through the shell by which it could be strung, the whole lot in question probably having once formed a necklace, or head ornament of great value to its owner. The occurrence of this and other marine shells is another indication of intertribal intercourse, or of extensive wanderings on the part of this ancient people.

In three other graves in this mound, beads made from marine shells were found. These beads were the same as those obtained from the mounds throughout the country, and have been cut principally from large marine shells, such as *Strombus*, *Busycon*, etc. Similar beads are figured in the last Report, p. 85, fig. 1. Many of the beads in this mound were very much decayed. Those that were collected are of three forms.

In the grave in which the perforated bear's teeth were found was one large, oval and symmetrical bead, three-quarters of an inch long and one-half an inch in diameter. About one hundred other smaller, well finished beads, with a diameter of about a quarter of an inch, and a length of about two-thirds the diameter, formed the rest of what I believe was a necklace, which we could probably reconstruct by placing the large bead and the two bear's teeth in the center with the small rounded beads on each side.

In another grave in which were several common, fresh-water shells, were also a number of beads very much decayed, but about twenty were saved. These are of two kinds, a small rounded form about a third of an inch long, and a flat bead having a thickness of not over an eighth of an inch, and a diameter of about one-half of an inch. In another grave was found a single bead like the last described.

In closing this account of the contents of the mound, I must reiterate that not a single article was found indicating contact with any other people than different tribes of their own race, and the same applies to all the other mounds of this important group on Miss Bowling's farm.

Having a desire to make an examination of one of the large mounds, of which there are many still remaining in the Cumberland valley, I accepted the invitation of the Rev. M. A. Matthews to explore one on land belonging to the family of Mrs. Matthews, and known, from the name of the family, as the Love Mound.

This large mound is twenty-three feet high, and, as near as measurements could be made, owing to the washing of the banks, 155 feet in diameter in a north-south line, and 147 feet in an east-west direction. It is located near the East Fork of White Creek, which flows in a southwestern direction to the Cumberland, entering that river about six miles distant in an air line.

In the immediate vicinity of the mound, on the north, west and south, are large artificial depressions, showing where the earth forming the mound was obtained. The excavations on the north and south have left a slight ridge, about a hundred feet in width and several hundred feet in length, to the eastward of the mound. About two hundred feet to the north of the end of this ridge is a small mound, nearly obliterated by cultivation, and about three times the distance to the southeast is an outcrop of limestone. Along this ridge, and towards the limestone ledge, are the traces of many stone graves of the same character as those already described. These graves had nearly all been destroyed by continued cultivation of the land, and I found but one that had not been disturbed. This grave was

six feet long, twenty-two inches wide and eighteen inches deep. The body had been placed in the grave with the head to the west. The skeleton was so far decayed that only a few of the bones could be saved, and the only article found in the grave was a portion of an ear ornament in contact with the side of the skull. This ear-drop was made of a piece of wood covered with a thin layer of copper.

An excavation was made in the center of the small mound, but nothing was discovered except the indications of a fire a few feet from what is now the surface of the mound.

The large mound was a land-mark at the settlement of the place, in 1795, by Joseph Love, the grandfather of Mrs. Matthews, and its summit has been used as a family cemetery, which somewhat interfered with the work of exploration.

In 1795 Mr. Love, as reliable family tradition states, "found a heavy growth of timber on the mound, and decayed stumps of red oak trees that were over two feet in diameter." Twenty-five years ago the mound was cleared of timber with a view of cultivating the sides, but as they were found to be too steep, it was again left to nature. The trees which cover the mound at present are, therefore, less than twenty-five years of age.

Four days, with six to eight men each day, were given to the exploration of this mound, in the following manner: A trench, four feet wide and forty-four feet in length, was cut on the southern side of the mound in its central portion, and running east and west. This trench was dug to the depth of ten feet. Two other trenches, fifteen feet apart, of the same width as the first, were then started from the first trench. The westernmost of these was carried eleven feet directly north, so as to reach as near the center of the mound as possible, without disturbing the several graves on the summit, The other trench was carried sixteen feet in a northwesterly direction, the two trenches terminating between ten and eleven feet apart. These two trenches were dug to a depth of twenty-three feet, when the original black soil was reached, upon which the mound was erected. At the bottom and ends of these trenches, tunnels were started so as to reach the center of the mound. Eight feet in length was thus added to the trenches, and from these tunnels auger borings, three feet in length, were made in all directions, without meeting with the slightest indication of a central chamber or relic of any kind. At it seemed useless to continue the exploration, the trenches were filled and the mound restored to its former shape.

The earth of which this mound was composed had been brought in small quantities, probably in baskets, and the outline of each little load could be distinctly seen on the sides of the trenches. This earth had, through the long period of time that must have elapsed since the mound was erected, become dry and compact and nearly as hard as sandstone. It was, therefore, necessary to loosen it by the pick, and much was thrown from the trenches in lumps by the workmen. The fineness of the material, and its freedom from stones and pebbles, were noticed by all at work, and it appeared as if the earth had been carefully sifted before it was placed on the mound. In the nearly five hundred cubic yards of earth removed

from the trenches, only the following extraneous things were found: In the long trench, at the depth of three and five feet, two small fragments of cannel coal, and at the depth of five and six feet, two small pieces of greatly decomposed limestone. In the two trenches diverging from the first made, and at depths of three, five and eight feet, four small pieces of limestone and a fragment of flint were found. At fourteen feet a piece of the shell of a *Unio* was discovered, while three or four flint chips and as many minute pieces of sandstone and limestone were thrown out at various depths. In the trenches near the center, at a depth of thirteen feet, were found three slabs of decomposed limestone, each of about twelve by eighteen inches, and one inch in thickness. The position in which these stones were found was such as to indicate that they were part of a circle of stones around the center of the mound when it had reached the height of ten feet. The decayed condition of these slabs of limestone and the formation, on the under side of each, of a thick scale of red oxide of iron, are indications of the great age of the mound itself.

The results of the exploration of this mound lead to the supposition that it was erected for some other purpose than as a monument over the remains of the dead, and, as the remains of numerous graves near it indicate a settlement at this place, it is very likely that it was devoted to some other important purpose of the people of the town.

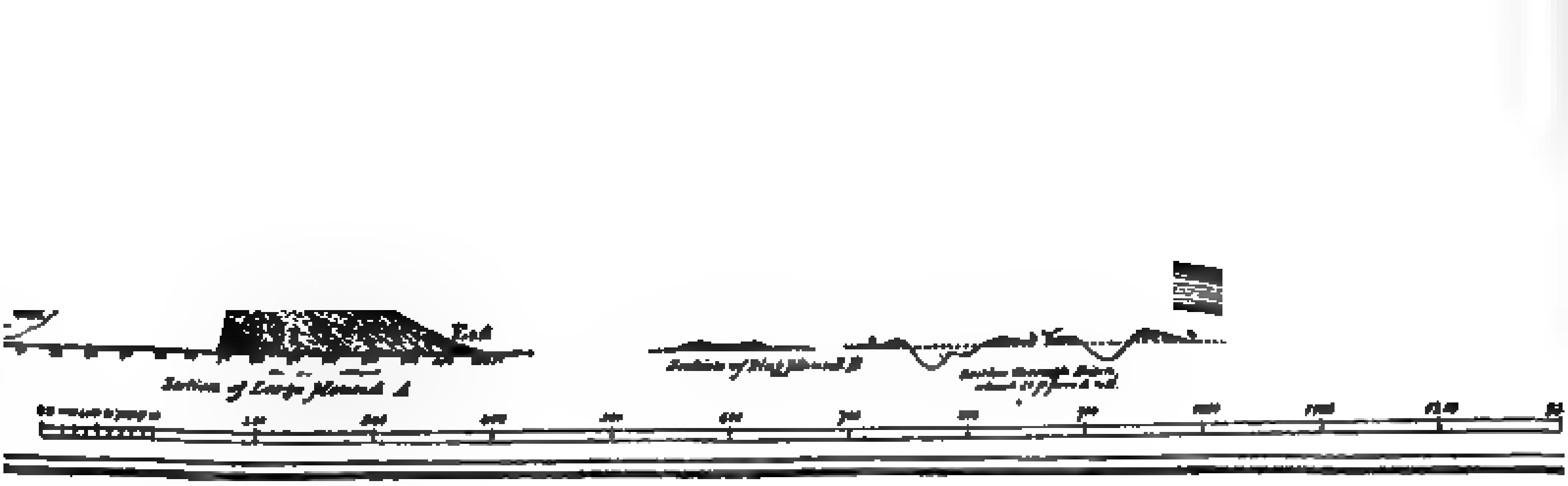
The most important of my explorations were those within the earthwork near Lebanon, in Wilson county, and about sixty miles east from Nashville. At this place, on the farm of Dr. Samuel Crockett, included in the estate of the Lindsley family, who were early settlers in the county, are the remains of an extensive settlement of the Moundbuilders of Tennessee. Accepting the kind invitation of Mrs. N. Lawrence Lindsley, Principal of the Greenwood Seminary, I was enabled, by her coöperation and the assistance of Mrs. Henry Lindsley, Dr. Crockett, and twenty-five workmen, to make, in a week's time, a comparatively thorough exploration of these remains, for an accurate survey of which, reproduced on the accompanying cut, I am indebted to Prof. J. H. Buchanan, of Lebanon.

As will be seen by an examination of the map, Spring Creek, a tributary of the Cumberland, makes at this place a bend to the eastward, where there is a limestone bluff. In this bend, near its narrowest part, is located an earthwork inclosing an area of between ten and eleven acres, and having its greatest length, of about 900 feet, in a north-south direction, and a width from east to west of about 650 feet. At nearly regular distances along this embankment, on the inside, are slight elevations at the angles of the earthwork. These are now eighteen inches higher than the embankment between the angles, and slope uniformly to the bottom of the ditch, which was originally, probably, between three and four feet in depth. Between the angles, the top of the inner wall is now not much over a foot above the general level, and the slope to the bottom of the ditch is divided into two parts by a level bench nearly three feet in width. The outside slope of the ditch, throughout, is uniform from top to bottom, and along its

outer edge is a crest about six inches high. The sections at the bottom of the map illustrate this structure—*a* the outer, and *b* the inner side of the ditch. At the eastern and southern portions of the inclosure are three causeways or openings through the embankment. Near the northwestern end, between the embankment and the creek, is a low mound, the existence of which I was not aware until the survey was made by Prof. Buchanan, after the rank vegetation, which covered everything at the time of my visit, had been destroyed by the frosts. At this portion of the inclosure, and to the southeast, the land is very low, and in the time of spring floods must be washed by the overflow from the creek. To the westward the land rises, and at the southwestern corner of the inclosure there is a rocky portion twenty to twenty-five feet higher than along the eastern embankment. Still further to the southwest, near the creek, the land is thirty feet higher than at the point near the creek on the northern side. On this southern bluff are six mounds, only a few feet in height, situated as shown on the map. Two of these mounds I caused to be trenched, and found that they were constructed of earth and stones which had subsequently been heated and burned by long continued fires, and there was no indication of their having been used for any other purpose. In the ditch, on the western side, is a large elm three four feet two inches in diameter. On the summit of the large mound within the inclosure were several large trees, among them a poplar two and a half feet in diameter, and a hackberry two feet in diameter.

Many other trees of considerable size were growing within the inclosure, and several large trees had fallen and gone to decay. While this tree growth does not, in all probability, give any approximation to the period when this ancient town was deserted, it at least points to a time before the intrusion of our own race, and everything found within the inclosure was confirmatory of the antiquity of the place. To the east of the embankment there is a depression, following the curve of the wall on that side, indicated on the map by parallel dotted lines, which looks like a former channel of the creek; and it is very likely that when the earthwork was made the creek flowed near the eastern wall, and has since cut its way four or five hundred feet farther to the eastward. The geological structure, contour of the land, and direction of the natural flow of the creek, are all favorable to such a change in the course of centuries.

The first object of attention in the inclosure is the large mound marked *A* on the map, and also shown in section at the bottom. This mound, as shown by the section (the shaded part in which represents the portion excavated), has steep sides and a flat top. Its dimensions are 138 feet by 120 at its base, and 95 by 75 feet on its summit, with a height of 15 feet. A trench was cut from the base of the eastern side and carried to the center, beginning with a width of four feet and gradually widening to fourteen. After the center was reached that portion was deepened to eighteen feet from the summit, thus digging down three feet in the original soil, consisting of yellow gravel and clay, which was found to have been previously undisturbed. The earth of which the mound was composed was


Section of Large Mound A
Section of Flat Mound B

very hard, dry and compact, and necessitated the use of the pick. The construction was the same as that of the Love Mound. At a depth of between three and four feet from the surface, near the center, were found three slabs of stone, each about twelve by sixteen inches, a stone chip, piece of mica, fragment of pottery, and a discoidal piece of sandstone (Fig. 31), with several grooves upon its surface, indicating that it had been used as a sharpening stone. At a depth of between seven and eight feet was an ash bed that had evidently extended over the surface of the mound when at the height of seven feet. In this bed of ashes were fragments of burnt bones, stones and pottery, a discoidal stone, an arrow-head, flint chip, portion of a shell of a *Unio*, several burnt corn cobs, a piece of charred matting, charcoal, etc. Under the ashes the earth was burnt to a depth of a few inches, showing that the ashes were the remains of a fire on the spot, and not material brought to the mound. At the depth of thirteen feet, a piece of cedar, a few inches in diameter and much decayed, was found standing upright, with its base below the surface of the earth upon which the mound had been erected. Between fourteen and fifteen feet, and thus on or close to the original soil, was another extensive bed of ashes, in which a few burnt bones of deer and pieces of charcoal were found.

Fig. 31.

Sharpening Stone, from Large Mound within Earthwork. Natural size.

The examination, therefore, showed that this was not a burial mound, and the two fires that had been made, with the relics found in the ashes, lead to the supposition that it was erected in connection with some peculiar rites celebrated at two periods during its construction. The place may have been the site of an important building. It is very likely that one stood upon the summit of the mound, and that all traces of it have been washed away after the decay of the structure, as would be expected upon such an exposed position.

To the southeast of the large mound, was one, marked *C* on the map, which was nearly three feet in height and forty-seven in extreme diameter, having a slight central depression twenty-six feet in diameter. On removing the earth, this mound was found to contain sixty stone graves, arranged in the form of a hollow square about the outer portion of the mound, in two or three irregular rows and in three tiers. The graves were carefully made with large flat stones, in the same manner as those I have already described, and were all of large size. The examination showed that, with the exception of one child buried in the same grave with an adult, all the bodies were adults and had been placed at full length in the graves.

The grave containing the bones of a child with those of an adult person, was in the lowest tier and among the first made. In this grave was found a large dish made of pottery, like the one represented in figure 34, and in this dish was the bowl (Fig. 32), reproduced of one-half its diameter. A small discoidal stone (Fig. 33) was also found in this grave, and is shown of natural size. Near this grave, on the inner side, were found the remains of a body that had not been inclosed in stone, and this was the only instance of the kind found in the mound. The skull belonging to this skeleton was saved (12003). In the lowest tier of graves was one that contained the remains of two skeletons, the skulls of which were saved (12014, 15). The only article found in this grave was a dish similar to No. 12009, which is figured.

Fig 32.

Bowl from grave, Burial Mound within Earthwork. ½.

In another of the graves of this lowest tier, in which the skeleton was much decayed, the following articles were found: A jar (12008), at the feet of the skeleton; near it the dish (12009) of which figure 34 is a representation, reduced to one half its diameter. With the bones of the hand was a pipe (12011) made of sandstone, which is shown of full size by figure 35. In the dish was a large bone of deer's leg (12010), which had been cut and broken, and near the dish was a small mass of graphite (12012), a pebble and a flint chip (12013).

Fig. 33.

Discoidal Stone from grave, Burial Mound, within Earthwork. Natural size.

In another of the graves of this lowest tier, were found the following articles: An ornament of very thin copper (12021), which was originally circular and with corrugated surface. Only fragments of this could be preserved, and its full size could not be determined, though it was probably four or five inches in diameter. An earthen pot, (12025), a dish (12024), and the skull (12022) were also secured. The remainder of these oldest graves in the mound yielded only fragments of pottery. As the earth of the mound was very damp, the pottery was soft and the bones were much decayed, so that great difficulty was experienced in taking the articles out, and it was necessary to have the pottery carefully dried before it could be handled.

Several of the skeletons showed the effects of inflammatory diseases, and a number of specimens of pathological interest were obtained.

In the middle and upper tiers, several graves were found containing relics. In one were portions of an ornament, circular in shape and about five inches in diameter, made of two sheets of copper closely united (12023), similar to that found in one of the oldest graves, and, like that, also resting on the breast bone, which, with the ribs, had been discolored and preserved by its contact. In this grave were also three delicate and well-made arrow-heads (12020), and an earthen pot (12019, Fig. 36).

Fig. 34.

Dish from grave, Burial Mound within Earthwork. ½.

In another grave were found three articles of pottery, viz.: a vessel with handles (12034), a large dish (12035), and a water jar (12033) of a pattern similar to others found, and represented by figure 37.

A similar jar of slightly different shape (Fig. 38), having the surface divided into portions as if designed after a gourd, was found at the feet of a skeleton.

Figure 39 represents a potsherd (12005) taken from one of the graves. This is probably a portion of a small bowl, and is an attempt, it seems to me, at a reproduction of the head of a bat the features of which are more apparent in the fragment than in the figure.

Pieces of mica (12038) were also found in one of the graves, and in another was a pipe (12040) carved from a dark slate (Fig. 40), which is of interest from its resemblance in form to pipes of recent manufacture.

In the earth between the graves, numerous fragments of pottery and a few perfect vessels were found. In one of the pots were two of the shell spoons of which mention has been made on a preceding page. A discoidal stone was also obtained. Between two of the graves, nearest the surface, was found the interesting pipe (11993), carved from green steatite, and representing a man holding a

cooking vessel which forms the bowl of the pipe, the hole for the insertion of the stem being in his back. The three views given in figures 41, 42 and 43, will con-

Fig. 35.

Pipe made of Sandstone, from grave, Burial Mound within Earthwork.

vey a better idea, than words, of this interesting relic. The lower portion of the figure is left unfinished as if that part had been inserted in a base of some other material, which is also indicated by a hole in the stump of the right leg.

GEOGRAPHICAL NOTES.

PROCEEDINGS OF THE CALIFORNIA ACADEMY OF SCIENCES, JUNE 16, 1879.

RECEPTION TO THE OFFICERS OF THE JEANNETTE.

A special meeting of the Academy of Sciences was held June 16, for the purpose of giving a reception to Lieutenant DeLong and the officers of the Bennett Exploring Expedition to the North Pole, who are to start in a few days in the steam yacht *Jeannette* from this port. The interest manifested in this expedition is very great, from the fact that it was started by the enterprise and liberality of the proprietor of the New York *Herald*, and, besides, the Government has recognized its importance by detailing competent and skillful officers to direct its operations. A large number of ladies and gentlemen were present last evening to listen to the exercises. Dr. H. W. Harkness, Vice President of the Academy,

presided, in the absence of President Professor George Davidson on official business.

The following members of the expedition were seated on the platform: Lieut. S. W. DeLong, U. S. N., Commander; Lieut. C. W. Chipp, U. S. N., Executive Officer; Lieut, J. W. Dannheimer, U. S. N., Navigator; G. W. Melville, U. S. N., Chief Engineer; J. W. Ambler, Passed Assistant Surgeon; Jerome J. Collins, Meteorologist and special correspondent of the New York *Herald*, and R. L. Newcomb, Naturalist. Beside these were Charles Wolcott Brooks, ex-Consul of Japan, and William Bradford, the artist.

The first thing in the order of exercises was the reading of the following paper on

FRANKLIN BAY, LAT 81°40'

ARCTIC DISCOVERY.

BY A. B. STOUT, M. D.

Mr. President and Fellow Members:—When, on a former occasion, we advocated the passage of a resolution by this Academy, addressed to the Congress

of the United States, advocating and soliciting the desired authority and appropriation of funds to organize the Howgate Expedition, to explore the Arctic Zone, and, if possible, reach as far north as the North Pole, the objective question was asked (and properly enough), "In what good can it result?" *Cui bono?* The answer was, that a full reply to the query would fill an octavo volume. We now offer a concise and condensed answer to the question.

To recapitulate the past as completely as may be, we offer the accompanying tabulation, which we hold yet open for correction, of Arctic explorations to the present time. This may offer a bird's-eye view of a landscape more sublime—more gorgeously colored than ever human painter aspired to portray.

The suggested resolution was adopted and transmitted to the Senate of the United States. The appreciative thanks of Captain Howgate for the sympathy of the Academy in his projected expedition have been duly rendered. The coöperation of the West has been appreciated at the East.

To advance another step to-night; to accelerate the onward march to the North Pole of our hopes; to yet further interest this Academy in a scientific search which now enlists the ardent impulse of every scientific academy of the civilized world; to endeavor to warm every sympathy international; to ingraft on our Government, which represents the progressive spirit of an enlightened people, aspiring to and indispensably requiring every aid in science to its practical promotion, is, in faithful zeal, the object of this communication.

To-day two great enterprises propose to record their birth date.

First—The Howgate Colony Expedition, already inaugurated by Congress, and commenced by the preliminary outfit under Captain Tyson to Disco Island to gather supplies and equipment for the so-termed Howgate Exploration.

Second—The Bennett Expedition, under Lieutenant DeLong, in the *Jeannette*, to take its departure from San Francisco on or about June 20, 1879. May our Academy wish them both God-speed on their eventful voyage!

It would be presumption on my part to expatiate upon the important problems in Astronomy to be solved by the discovery of the North Pole. These are scientifically indicated by W. E. Hickson, Esq., in a paper on the climate of the North Pole. [See Journal R., Geog. Soc. vol. 35, p. 129, 1665.]

Herein is a clear elucidation of the effect on Arctic summer and winter of the earth's relation to the sun; of the necessity to fix with precision the location of the Pole—to determine the flatness or the projection of the earth's surface at the Pole—to measure arcs of meridians; to give greater exactitude to the fixation of latitude and longitude of cities; to show the alterations of climate in long cycles of time; to compute the gradual variation of the plane of the ecliptic to that of the equator, with the consequent meteorological conditions. This author inclines to the belief that land exists at the Pole, and proposes, in order to complete astronomical observations requiring time for their consummation, that all interested scientific nations shall combine to erect there an international observatory. With steam power to aid, he sets no limit to his proud ambition.

Captain Sherard Osborn, writing in 1866 (Journal R. Geog. Society, vol. 36), says most truly: "Arctic discovery must always claim the attention of all true lovers of geography and physical science, especially that of a society which represents the deep interest recently exhibited by all grades of the public in the solution of the problem of a communication between the Pacific and Atlantic, and of the world-wide sympathy in the noble devotion by which that mystery was solved." He informs us that, from an estimate of Sir Leopold McClintock, the foot expeditions in search of Franklin alone, measure 40,000 miles, and that during thirty-six years of explorations by ship, boat and sledge, England only lost fairly one expedition, in forty-two successive expeditions only lost 128 men, and of one hundred sledge parties, not one has been sacrificed. He further states in extenuation of the perils, hardships, starvations, and dreadful exposures of life, that "the fact is, more sailors have been thrown to the sharks from the diseases incident to service in China, and on the coast of Africa, than ever fell in thirty years of Arctic service."

He calculates that from where, in 1827, Sir Edward Parry, in his boat expedition from Spitzbergen, stood on a sea of floating ice, on the night of July 22, 1827, in latitude 80° 45′, he was exactly 435 miles from the Pole. This distance, doubled for the return journey, gives 870 miles to travel; but Parry was defeated because the floating ice-field was carrying him faster to the south than his men could drag the sledges to the north.

From Cape Parry to the Pole and return is only 968 miles; while, in 1853, McClintock traveled 1220 miles in 105 days. Meacham, in 1854, marched 1157 miles in seventy days. In fine, Captain Osborn, in his enthusiasm, rather courts than shuns Arctic life; proves its endurability, in spite of its rigors, by the health and vigor of the "Arctic Highlanders," and presents, as the reward of the great achievement, 1,131,000 square miles of the globe's surface

A letter to Sir R. J. Murchison, from David Gray, Esquire, a whaler, in 1868, is worthy of note as indicating a fourth route to the Pole (Pro. R. G. S., v. 12, No. III.). It gives most cogent reasons for the adoption of this route, especially as it avoids the rush of water and ice southward through Smith Sound and Baffin's Bay.

Gilbert, in 1600, announced the bold hypothesis that "the earth is a great magnet," but he did not announce the cause or origin of the magnetism. But it was in 1576 that Robert Norman first discovered the dip or inclination of the magnetic needle, on the ground that if, at the magnetic equator, the needle poised precisely horizontally, it must follow the curvature of the earth and dip as the needle was removed from the magnetic equator toward either the North or South Pole.

We have not space to enumerate the various and conflicting hypotheses advanced to explain this astonishing terrestrial magnetism. But the problem still remains to be solved. No explanation has yet passed the crucial test of scientific investigation. The nearest approximation has not yet met with conclusive confirmation.

Gauss, Ampére, Hausteen, Goldsmidt, and others, studied the phenomena of magnetic currents, and the needle's dip and variation as they existed in fact, but did not prove the origin of the magnetism. Practical results of great value were obtained. Finally, General Sabine discovered and announced, that under the various intensities of the action of the sun on the earth, the magnetic phenomena of the latter received very demonstrable variations in direction and intensity.

In the United States, Professor Bache, aided by numerous scientists, among whom figures the name of Dr. Kane, and also the United States Coast Survey, have together made important magnetic charts for the aid of navigators, and explorers on land. If General Sabine has demonstrated an important dependence of the earth upon solar magnetism for its magnetic phenomena, Dr. Kriel, of Austria, has endeavored to enlist the moon as a potent factor in terrestrial magnetism Professor Schwabe, German, has, by thirty years of daily observations, demonstrated that important relations exist between the variations of terrestrial magnetic intensities and the variations of the sun spots "brighter than the sun" [See *Popular Science Monthly*, Sept., 1874, p. 536], thus giving testimony in favor of Sabine's researches.

However advanced this state of knowledge may be, it is still surrounded by an obscurity not yet resolved into unclouded light. The "open sea" of conjecture, ice-bound as it may be, is free to the suggestions of all explorers. It even may yet be the destiny of some unpretending whaler to reach the North Pole in advance of the efforts of science, aided with all the power of steam.

We may, then, venture upon an hypothetical solution. The velocity of the earth's motion in its orbit around the sun is computed at 68,000 miles per hour, or 1,632,000 miles per day. The velocity of the earth's rotation on its axis is calculated at 1,000 miles per hour, or 24,000 miles in twenty-four hours.

In accordance with the law of correlation of forces, we may consider that motion is converted into magnetism by the action of friction. Certainly, in the immense velocity of the earth's motion, in atmosphere as well as in the ether space external to the earth's atmosphere, there is friction.

However attenuated may be the ether in which atoms move, there is still some friction. The earth, in its orbit around the sun, moves in a medium of different density than that of the planet on its axis; hence the quality, the quantity and the intensity of the magnetism, or dynamo-electricity, evolved by the two velocities in different media, would also be differentiated.

Again, if the earth's motion be converted by friction into magnetism, the friction being over the entire surface, the evolved magnetism must alike be generated over the entire surface everywhere within its range; but in accordance with natural laws, the product is collected or attracted into great magnetic currents, as the waters of the ocean are organized into great gulf streams.

The magnetic currents generated by the earth's motion on its axis could not stream through the exact geographical axis, but would be deflected, and therefore

we have magnetic poles removed a distance from the true North Pole. It is evident, also, that herein the sun's action on the earth would have its influence on the direction of the magnetic currents.

Within these two great streams of magnetism, either sufficient in force and never-failing supply to produce the terrestrial phenomena, and acting in differing lines, we have an intelligible origin of one of Nature's grandest and omnipresent energies.

The frost flower forms not on the window without its influence; the most elaborate crystal is the creature of its wonderfnl attraction. Eliminated in the brain, our thoughts are its children. Metâmorphosed by the Divine will into a correlated force, Heaven's pure light illuminates the world. And, again, converted into heat, its genial warmth fertilizes every flower; while, in its turn, the solar beam relinquishes its unity of composition, and from its prismatic rays adorns in gorgeous coloring every petal, sports in fantastic grace with the feather of the bird and the beauteous wing of the butterfly, gilds the glowing morn, and at even, on western sky, utters in radiant colors its benediction, like the voice of God—good-night to weary man.

This faint picture brings us to the Aurora Borealis, that beautiful creation of the Polar Zone, that translucent light of the North, which man, with all his genius, can never imitate, but, like the Arab kneeling to the Sun, from the desert of his mind can only worship.

For a time, the perturbations of magnetic currents, strange variations of the needle, perplexing irregularities of the compass, often so fatal to mariners, were ascribed to caprice, were termed "fitful," so fitful as to become at times "magnetic storms;" but patient investigations like those of Schwabe have reduced this wild behavior to the regular events of natural laws, acting at certain recurring intervals. Astronomers have demonstrated that the motion of the earth on its axis, as well as in its orbit, is accompanied with an oscillation like the majestic swaying of a vast balloon. This motion must also act as a perturbating influence.

Now the motion of the earth, in its orbit around the sun, generates its own magnetism, which, in its turn, must be collected into its own determined currents, and these may circulate in lines widely different from the former great magnetic tide; these, also, may undergo perturbations depending upon the varying proximity and heat of the sun, as well as the condition of the luminous sun-spots, which, in their intensity of light, are represented to rival even the sun himself, as viewed by man.

Exultant in the wonderful beauty of these phenomena, as we sit, without peril, in our Temperate Zone, let us borrow a few lines from those who froze and trembled, but yet could not resist the glorious inspiration of Nature's majesty:

"During the first morning watch the sun, hitherto hidden by the mountains of Grinnell Land, suddenly shone out, causing a universal exclamation of wonder and delight. The line of reflected light was singularly brilliant where it crossed the patches of water, and it was rendered iridescent where it fell on the edges of

the hummocks, on the fractured ice, or on the pack itself. The irregular surface of the pack itself, comprising the general level of the young ice, the undulations of the old floes, and the sharp prominence of the old bergs, together with the unending diversity of form in the hummocks, kindled the imagination, which discovered every variety of form and of object, animate and inanimate.

"The bottoms of these floes are usually covered with small lakes, formed during the short summer by the melting of the ice and snow. These lakes are frozen solid during the winter, but in the summer and early autumn they reflect the sun from their surfaces, and exhibit a variety of colors beneath." [See N. P. Expedition of ship *Polaris*, pp. 77 and 98.]

Happy the nature-enamored enthusiast who, for a weary winter of darkness, can exult when he wins a reserved seat on a glacier, in the dress-circle of the Arctic Zone, thus illuminated, and revel with delight in this grand opera of Nature's play of colors. For our meek self, during a short season, we prefer a Boston rocking-chair, an opium pipe, and schoppen of lager. Under the hallucination of De Quincy, we would perceive the

> "Borealis race
> Which flits ere you can point the place,"

in a much more favorable light. These Arctic splendors are optical phenomena of reflection and polarization, but when they become blended with the still grander evolutions of terrestrial magnetism, an explanation appears to be found for the inimitably gorgeous pyrotechny of Northern Light. The effulgence of electricity, liberated from its unseen terrestrial current into brilliant light and prismatic colors, beams on the sky, illuminates with its fulminating rays the Northern Zone, and constitutes the Aurora Borealis.

What, then, are the advantages of Arctic exploration? What bounties will it return? What dividend from the stock? Of what good to man is this martyrdom of men?

We now seek in California some "high eminence" whence the heavens may be viewed through the most rarified, translucent atmosphere. What grander observatory can be found than the Pole itself? What more felicitous site to observe the inexhaustible fountains of terrestrial magnetism than at the fountains of its concentration and departure on its wonderful cosmic errand? Where better might a Tyndall borrow the elements of light, a Hemholz measure the free vibrations of sound, or a Geissler supply the tubes of his wondrous electric fountains and dazzling display of light?

When some thirty years ago a distinguished representative of California declared in Washington that California was a desert, and its land worthless for agriculture, and we now view its acres supplying the world with wheat, it cereals in every form filling the markets for the hungry, its luxurious vegetation adorning plain and hillside with its unrivaled scene of floral beauties, inviting exotics of every land to come and contest with them the palm of loveliness, the fruits so overwhelming in abundance that we fail to consume them, the products of the dairy,

which so immensely accumulate despite the cost of production—let us still remember that centuries ago a glacier mantle, far heavier than that which congeals the germs of life in Greenland, ploughed with corroding power over the now called heaven-blessed fields of California.

The achievement to first arrive at the North Pole and determine its physical "presentment," is no longer the actual competitive prize of international rivalry. Eager as each nation may be to win the victor's "belt," the attainment of that consummation, so devoutly to be desired, has become a secondary considation. To cast a girdle round the globe is now a lightning-quick affair. To find the polar center of that great zone is now the struggle, though often baffled, yet surely destined to be accomplished. Meanwhile, science has adopted the field and its produce as her own. Higher primary objects have intervened, to decorate, to adorn, to illuminate the subject. Every polar expedition, whether or not a failure to find the pole, shortens the distance from 83° 26′ to the goal. Every station taken to measure soundings, to find warm and cold currents by thermometrical tests, to dredge from the vasty deep its forms of animal life, is an advance in science. To press into the service of science a tiny flower, which, by the quick telegraphy of a polar actinic ray, has in a few days burst open the frozen cerements of a nine months' glacier; to bring home a rock, a stone, to enhance geological lore and contribute its mite to the great story of this world; to tell what life existed by its fossil memorials and in its etchings on the land-marks by the graver of an almighty sculptor; to teach us the history of those grand cosmic revolutions which man yet fails, with all his labor, to unravel; to trace the course of the great current of the Pacific Ocean through the intricate straits and sounds of the Arctic waters into the Atlantic Gulf Stream; to profit by those tides instead of struggling by main force through Davis Straits in a counter current, manfully tilting with icebergs and northern gales; to show the route of the uprooted tree fallen from the banks of the Mississippi, in its wanderings on the ocean until, stranded on the Arctic shore, it gladdens the heart of a hungry Esquimaux, who warms with its heat his scanty evening meal, and inspires grateful orisons to his Creator.

All these, with objects yet unthought of, are the guerdons of the toil. What, though a hard and violent death may leave to many a zealous hero no other reward than the glory of his deeds, are not the earnest martyrs of science found on every field of life and in every clime? Would not the thought-exhausted Peteman have better found his storm-beaten monument by the side of Franklin, or where Hall died? Is not his unhappy fate the destiny of thousands of his too ambitious followers?

Quickly in the wake of science will follow commerce. Enterprising as she may be, she will not venture her argosies without high insurance. More stations, better charts, sharper defined coast lines, more thoroughly established "open water" must precede her cautious navigation. Still, with *her* success will be answered the mercenary *cui bono* inquiry.

The riches that have been derived from the polar latitudes are too immense

to be calculated to-day. Whale oil and spermaceti are not yet entirely superseded by gas and kerosene, and if they were so, whalebone or baleen is yet of high value. A whaler of to-day is paid for his voyage in baleen alone.

The discovery of coal in Behring's Straits and in a high latitude on the west coast of Greenland will greatly diminish expense, while the income will be in a far greater proportion increased. The produce of furs must be greatly augmented; the accession to the minor fisheries, with less peril to life and shorter voyages, cannot be estimated. In Siberian seas, salmon exist in countless multitudes. Many steamers navigate the great rivers of Northern Russia. With these trade will be opened. California wheat will penetrate to the interior of Russia, and American manufactures, now prized throughout the world, can pass Behring's Straits to be sold in Tobolsk, on the Obi.

Besides these, elephant ivory, walrus tusks, mosses, lichens, feathers, *et id omne genus*, abound to court the grasp of predatory man.

The cost of former Polar expeditions is far less than might be supposed. Thus, Willoughby's expedition, 300 years ago, cost $30,000; Moore's expedition, in 1746, $50,000; Back's expedition, in 1833-5, Great Fish River, $25,000; Meddendorf, Siberian, 1844, $8,583; Franklin expeditions, from 1848 to 1854, $4,166,665 (English Admiralty statement); German North Pole expedition (second), $55,000; Austro-Hungarian expedition, $91,665.

The cost of an ordinary whaling voyage of nine months, vessel of 300 tons, or 1,000 barrels of oil, including vessel's value, is about $35,000. A whaling vessel from San Francisco, from March to October, is calculated on those conditions. A whaling voyage from New England was fitted for three years at an investment of from $60,000 to $70,000.

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To counteract the depressing influence of intense cold requires the consumption of the great bulk of internal animal heat derived from the food eaten. It is only a comparatively small balance of energy, of vital force, which remains for the great labor demanded by the journey. More than one-half of the composition of the human body is fluid. An Indian skeleton, perfectly desiccated, now in our Museum, weighs nineteen pounds.

When, then, we remember that in the Arctic belt the thermometer sinks forty, ay, fifty, degrees below zero Fahrenheit, we inquire in wonder, Why does not all that fluid freeze, and in its congelation leave the man a lifeless statue of ice? Why does not the blood freeze in the heart? Why are not the blood channels by which the brain is irrigated, its loss and gain by wear replenished? Why are not the aqueous and vitreous humors of the eye crystallized into solid ice? It is because the supply of heat from the accelerated rush of blood through the system is called upon rapidly to supply the waste by the extreme cold. When this balance of power fails, the individual must die. This thirst for heat is manifested by the voracious appetites of Arctic hunters. When, then, this extraordinary effort of the brain to furnish the exalted heat strain is considered, without even

reference to the demand for great external manifestations of vital energy, it cannot be wondered at that the vital fire of life burns low, and all the structures of the body degenerate into that state we designate as scurvy.

A first curative relief, then, is to study the economy of this brain force and vital heat. No waste should be allowed by the expenditure of strength, except for indispensable necessities. We would deprecate exercises for mere amusement to keep men in motion, but recommend rest moments at well advised intervals

While stimulants are highly requisite, if we force the fire too rapidly by artificial fuels, in the long run we shorten the life to be consumed. Among the known anti-scorbutics, lime juice, raw vegetables, etc., the abundant Oregon cranberry ought to figure as valuable. Among trappers and hunters, pinole is highly prized. The earthy phosphates are powerful brain nutriments, but those of the alkalies have the objection that their large proportion of soda, potassa, or ammonia, thins and dilutes the blood. The Indian carriers of heavy loads in the Andes use the coca leaf. The action of this plant is to increase endurance, and obviate the almost irresistible desire to sleep in the most surprising manner. The fluid extract of coca, therefore, ought to be an invaluable aid; but as this freezes, and is difficult to transport, we have composed a dry powder condiment which every man can easily carry in his pocket. This condiment can give a relish to many a raw or revolting meal with which the Arctic explorer is forced to satisfy his long-forgotten Epicurean taste.

When the traveler in the North has acquired what may be called the scurvy diathesis, he is beset by another direful scourge. Frost-bite is greatly facilitated. His feet swell, and he must loosen his fur or canvas boots. The neuralgia in the frost-sores becomes excruciating, labor impossible, and the highest degree of nervous irritability is engendered. This pain, so much exaggerated beyond that of a simple local wound, indicates how intimately the state of the brain is connected with the local accident.

It so complicates and imperils life that, during the Crimean war, the surgeons were restrained from amputations. The young surgical assistants were absolutely forbidden to touch the frozen parts with the knife.

It is manifest, then, that the brain must be first appeased before local treatment can avail. In the Austro-Hungarian expedition, Payer states that collodion, with iodine, was often of great use as a local application.

We would infer, though having no conclusive experiment, that magneto-electricity would serve to reanimate the failing nervous system.

An induced current passed through the brain and spinal axis might supply new energy, while, as a local stimulus, it would revive languishing granulation in frost-bite ulcerations, promote cicatrization and appease, perhaps, the excruciating neuralgia of the sores.

Should the electric light be employed on the Bennett Expedition, a diverted current might be passed through an apparatus to reduce intensity, and be thus utilized as an hygienic appliance.

We would further indicate the fluid extract of malt, associated with the hypophosphite salts, condensed milk and compressed coffee.

The new antiseptic, borate of soda and potassa, to preserve meats, fish, etc., will be an invaluable acquisition.

Who shall own these vast possessions? Who owns them now?

At present, all explorers, all nations, are pleased to penetrate the vast embattlements which mark and guard the Pole, the floes, the bergs, the hummocked crushing masses, "old ice" on one side, "new ice" on the other, dense fog, ice below, snow above, the northern blast, the unconquerable glacier—and who shall win the first discovery, "so longingly coveted?" But all are too happy to escape with their lives therefrom, and be welcomed again to the genial home.

Already on cape, sound, strait, and bay, on every "land" floats the possessory banner of a nation. Should a climatic revolution suddenly restore to fertility and civilization, warmed with tropical temperature, what would not be the contests in International Congress to fix the frontiers! History would repeat itself. The autochthones would be ignored. The native proprietor, whose favor we now court with trivial presents, would be again despoiled—whose furs, dogs, sledges, we now purchase with paltry bribes or insignificant tools for their simple industry, would be assigned to reservations, with Indian Agents for their Great Father.

The walls of China have been overridden and the nation forced from its seclusion, now again to be driven back within its broken parapets. In like manner will the feeble but indispensable Esquimaux be first courted with bribes, caressed, and then of his ice-girdled home be dispossessed.

We can but say, such is mankind; such the human race. "Such," exclaims Burke, "is the mode of existence decreed to a permanent body composed of transitory parts wherein, by the disposition of a stupendous wisdom, moulding together the great mysterious incorporation of the human race, the whole at one time is never old, nor middle aged, nor young, but in a condition of unchangeable constancy, moves on through the varied tenor of perpetual decay—fall, renovation and progression."

Evolution and involution succeed each other in their eternal orbit.

As Pioneers of Science in this "Western land," we can only exclaim to our proposed expeditions, the daring pioneers of the Arctic Zone, while we wave to them in farewell the banner of our country, hoping again to run it to the peak to salute their safe return, "GOD SPEED THEE!" and impress on their mind our favorite motto, with Liberty presiding over the two Americas, "*Hæc sit Patria Nostra!*"

Dr. Harkness then introduced Lieut. DeLong, the commander of the expedition, to the audience, who was received with much applause, and who spoke as follows:

"When the officers of this expedition were invited to attend this meeting, I answered that nothing would give us greater pleasure, but we hoped to be excused from taking any part in the discussions until after our return from the Arctic

regions. This amiable peculiarity of ours, it seems, is not to be tolerated, however unfit I am to reply with any degree of propriety to the very kind expression of your wishes. As for this particular expedition, there is nothing much to say. It has been made possible by the liberality and enterprise of a single individual, and he has placed it in charge of officers of the Navy, and by an Act of Congress it has been awarded official sanction. It is peculiar in another way, for it is the first attempt to reach the North Pole by going through Behring's Straits. Other vessels and expeditions for the relief of Sir John Franklin have gone through this Strait, but this will be the first practical Arctic Expedition to attempt this route toward the Pole. We expect to undergo the same trials and embarrassments as other polar expeditions have met with.

"We shall begin our work at the 71st parallel of latitude. Beyond this, all is unknown, and we shall first determine whether there is land, ice or sea. You will excuse us from further outlining our work until our return, when nothing will give us more pleasure than to tell you what we have done."

Dr. F. Baer, J. P. Moore, Chas. W. Brooks, Wm. Bradford, on the part of the Academy, and Jerome J. Collins, a member of the Expedition, also spoke on the occasion, after which the meeting adjourned.

A REMARKABLE BILL!

A Bill to authorize and promote international inquiry and conference as to the practicibility of extending the channels of the Bay of Fundy and of the Mississippi River to and through Hudson's Bay, introduced by Mr. Blair.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of War is hereby authorized and directed to cause and invite a preliminary inquiry and survey into the practicability and probable results and costs of the following proposed changes and improvements in certain rivers and seas of North America, and to report to Congress at as early a time as practicable the results of such inquiry and survey.

And it is hereby ordained and provided, That the subjects of inquiries and surveys and conferences in pursuance of this act shall be in detail as here follows, and shall be considered under the methods hereinafter described:

To extend the channel of the Bay of Fundy to and through the Gulf of Saint Lawrence and through Labrador to Hudson's Bay; to extend the channel of the Mississippi, and compel a flow of the thermal water of the Gulf of Mexico through such channel or channels into Hudson's Bay; to conduct the watershed and tidal currents to and through Hudson's Bay, as a thermal flood, to make that bay an inland thermal sea, with the purpose of ameliorating and equalizing the climate of the whole continent; to obtain by these north-going thermal waters "a warm inshore current," and the opening to commerce of the Northwest Passage and of other channels now closed by ice; to give to the Lower Mississippi, from

the Gulf to the greatest practicable inland distance, a constant sea-level, thus preventing inundations and consequent epidemics; to select locations for the formation of inland lakes of sufficient area to detain the waters of the upper affluents, and thus protect our rivers from freshets and from shoals.

METEOROLOGY.

PARADOXICAL PHENOMENA IN ICE CAVES.

J. RITCHIE, JR., BOSTON, MASS.

[Concluded from July Number.]

The theory suggested in the same report, page 207, is one of non-conduction and is more general, depending in part upon the absence of subterranean water courses and ascending streams of warm air.

Last, comes the theory advanced by Mr. Browne, which he states to have been independently deduced by himself and by M. M. J. LeDuc, and is, "that the heavy, cold air of winter sinks down into the *glacieres*, and the lighter, warm air of summer cannot, on ordinary principles of gravity, dislodge it, so that heat is very slowly spread in the caves, and even when some amount of heat does reach the ice, the latter melts but slowly, for ice absorbs 60° cen. of heat in melting; and thus when ice is once formed it becomes a material guarantee for the permanence of cold in the cave." In the arguments adduced to support his theory, there is not one that is not unquestionably an aid to the preservation of cold in the caves, and is undoubtedly the real agent in the case of some, at least, of the caves he describes. Allowing, then, that his theory does cover the cases of all the caves of which he has been an explorer—for a discussion on this point would be not of the slightest importance as regards Mr. Lowe's theory—there remain still, as acknowledged by Mr. Browne, the caves in which it is impossible wholly to disregard the popular belief that thaw does occur in winter. In this case, Mr. Browne admits that his theory will not be adequate; and, at the same time, he does not express himself as satisfied with any of the other theories as yet advanced. That of Mr. Scrope he mentions as perhaps being to the point, but seems doubtful, indeed, as to whether it is sufficient. The theory of Mr. Scrope is specially adapted to those caves which occur only in basaltic or volcanic formations, and presupposes a connection of the cavern with the outer air at some other level, thus giving a circulation, as is known to be the case in mines. This passage, according to Mr. Scrope, may to a certain extent be a dessicating tube,

owing to the sulphuric or muriatic acid held by the porous, volcanic rock, and the air, completely deprived of its moisture, seizes that of the water and thus freezes it from its own evaporation. These assumptions may not be altogether improbable in the caves of a volcanic stratum; but in the case of the cave of Illetzkaya, which is in gypsum, or that of our own cave of Decorah, which is limestone, and unquestionably has no other opening (save a small fissure), how can the phenomena be explained? Evidently the theory of Mr. Browne is by his own statement inadequate, while that of Mr. Scrope lacks two of the most important elements.

That the explanation of Mr. Lowe completely supplies the lacking elements, seems the more reasonable the more research and thought we give to the subject. That its action is simple, as are all the actions of nature, is an argument in its favor. That it has not been before thought of, is perhaps curious, but at the same time, the fact is that the real action of the compression of air by the Frizzel air compressor, or by the tromp (for the explanation of which latter see "tromp" in almost any mechanical dictionary), has not until lately been known, and, although the result has long been acknowledged, still the process was not traced out until the researches of Mr. Frizzel. This, then, may be considered as a principal reason why such an explanation has not been sooner advanced.

It does not, then, admit of the slightest question but that air brought down from a height by streams of water, will in its descent be subject to constantly increasing pressure. In his treatise on heat, Boz states directly, that "if compressed air be deprived by cold water, or by other means, of the heat developed by its compression, and then suffered to return to its normal volume by relief of the pressure, a very low temperature is obtained." It is also well known that a stream of water flowing through fissures in rock, will be kept at the temperature of the rock. In speaking of the ice well at Oswego, New York, Silliman states in his Journal (xxxvi, 184), that he would be well pleased to be able to account for the phenomena in this connection, and further says, "Could we suppose that compressed gases, or a greatly compressed atmosphere were escaping from the water or near it, this would indicate a source of cold," but he could find no indication of this nor any reason for the compression.

Combining the facts above given, as has been done by Mr. Lowe, the cause and effect, so far as regards ice caves, may be readily traced. The cave at Decorah appears to be peculiar in one feature—the perfection of its action; and in it the absence of other aperture, and of volcanic rocks, present problems that are solved with extreme difficulty by any of the previously announced theories. There do not exist in caves good conditions for evaporation, yet, for the most part, the air in them is of the best, and the circulation, produced by the same means as the freezing, is perhaps a thing to be considered. The liberation of compressed air, then, in caves, may give rise to a variety of phenomena. There may be freezing in winter, provided mingled air and water can reach the cave; there may, and probably will be, freezing in summer, or at the time of the greatest rains, for then mingled air and water do find their way to the cave; there may be freezing

all the time, for the conditions necessary for a constant supply of air and water are not difficult to imagine nor unreasonable; there may be no freezing, but simply a current of cold air; one or all of a series of caves, which have heretofore been considered as precisely of the same nature (for example, Illetzkaya), may, in some cases, present some or all of the phenomena, or none. It seems to be the first reasonable explanation, which does, from its very simplicity, cover all the cases of the kind.

That the facts collected by Mr. Browne are justly stated, and in some or perhaps all of the instances quoted by him, will fulfill the requirements of the case, is reasonable enough; but there is, we should judge, a fulfillment in nearly every case, of the simple requirements of Mr. Lowe's theory, and it is highly probable that his explanation and that of Mr. Browne go hand in hand so far as the latter desires to carry his theory, but then facts that do not support the Browne theory will be found to well support Mr. Lowe's. The inclination of the entrance to the caves has been sufficiently discussed by Mr. Brown, and it is not necessary to more than allude to it, while the presence of a snow slope in the inclined entrance would be evidence of a dual phenomenon, the snow being the remains of the previous winter's fall.

In the majority of the caves, direct mention is made of the means by which the water reaches the cavern; and in the main the freezing may be directly traced to this source. Generally fissures can be found. In Decorah, mention is made of a fissure, and the description is so exact, even when compared with the conflicting statements in *White's Geology of Iowa* (i, 80), as to be worthy of some credence. In a number of the caves of Mr. Browne, fissures are mentioned, and generally as the source of an ice pillar. In the *glacière* of Monthezy, domes are mentioned, filled on the interior and sides with ice; while in the cave of Illetzkaya, an old fissure in the hill was mentioned by Pallas (*Voyages*) as existing long ago, but now no mention is made of it; while in Pictet's account of the Neidermendig quarry (*Mem. Geneva*, i, 75), the formation of ice in this way is mentioned. Mine shafts, both in Sweden and in Russia, and at Port Henry, near Lake Champlain, New York, exhibit phenomena of this nature; in all cases the ice forming at a considerable distance below the top of the shaft. Mr. J. C. Ward, in *Nature*, xi, 310, mentions a temporary ice cave in a mine in Cumberland, England, but the phenomenon there is of rare occurrence.

A parallel case to the cave at Decorah, at least so far as can be judged from the description, exists in the Val d' Hérens, near Evolena, and is mentioned in *Nature*, xi, 327; the similarity may be, however, merely in form and not in phenomena.

The liberation of compressed air in a cavern may or may not produce a perceptible current within or at the mouth of the cave. When the quantity of air brought down is large in proportion to the size of the cave, perceptible currents may ensue; and, from the description given in the *Scientific American*, such might reasonably be expected to be the case at Decorah, White's statement to the con-

trary notwithstanding; and it may not be too bold to claim that a portion of the air in circulation in caves, whether ice caves, cold or blowing caves, stalactitic, or ordinary caves, may be due to the liberation of compressed air, and the agency of the latter may perhaps be traced in still others of the phenomena of caves.

The formation of stalactites and stalagmites themselves may be due in part, at least, to the same cause; and it is necessary merely to assume that the stream containing the compressed air is at the same time saturated, or nearly saturated, with mineral matter, and it will, when lowered in temperature, lose some proportion of its solvent power.

The question of the agency of compressed air and gas in the solution of natural phenomena, has received but little consideration as year, and it would seem to widen the field a little for experiment; and while its proof is a matter that requires more facts and special investigation, it would hardly seem proper to condemn it without due and lengthy consideration.

In conclusion, then, it may be seen that some of the elements of Mr. Lowe's theory have already been advanced, and by able scientists:—the possible effect of compressed air, by the elder Silliman; the effect of surface frost as modifying the water supply, by Mr. Hope (*Ed. Phil. Jour.*, xxxv, 192); the possibility of air bubbles being imprisoned in a stream of descending water, by Mr. J. T. W. Johnston, in a paper before the Royal Society of England,—all have been steps toward the solution of the problem of the formation of ice in ice caves, but to Mr. Lowe must be rendered the honor of tracing the relationship between cause and effect, and even should it in some cases apparently fail to explain fully the phenomena, still it is undoubtedly a step in the right direction, and should it even have no greater effect than the collection of data and observations on the subject, its value even then would be great.

It was our intention, and we had prepared for publication, a list of the known ice caves, with their peculiar features, for the purpose of comparison with this and with other theories, but, for obvious reasons, it must be delayed until another issue, together with explanations of other natural phenomena.—*Science Observer.*

KANSAS WEATHER REPORT FOR JUNE, 1879.

BY PROF. F. H. SNOW, OF THE STATE UNIVERSITY.

Mean temperature, 73.22 degrees, which is 0.77 degrees below the June average for the eleven preceding years. Highest temperature, 97 degrees, on the 9th; lowest, 45 degrees, on the 2d; range of temperature, 52 degrees. The mercury reached or exceeded 90 degrees on 12 days. In June, 1878, it did not once reach 90 degrees. Mean temperature at 7 a. m., 68.30 degrees; at 2 p. m., 83.20 degrees; at 9 p. m., 70.78 degrees.

Rainfall, 7.14 inches, which is 1.92 inches above the June average. Rain fell on 13 days; there were 9 thunder showers, two of which brought a small amount

of hail. The storm from 5 to 6 p. m., on the 9th, was very severe, the wind reaching a velocity of 60 miles an hour, and unroofing several buildings in the city of Lawrence and vicinity.

Mean cloudiness, 41.33 per cent of the sky, the month being of the average cloudiness. Number of clear days, 12, (entirely clear, 2); half-clear, 13; cloudy, 4, (entirely cloudy, 3). Mean cloudiness at 7 a. m., 43.67 per cent; at 2 p. m., 49 per cent; at 9 p. m., 31,33 per cent.

Wind.—S. E., 28 times; S. W., 23 times; N. W., 14 times; S., 7 times; E., 7 times; N., 4 times; N. E., 4 times; W., 3 times. The entire distance traveled by the wind was 0,498 miles, which gives a mean daily velocity of 316·60 miles, and a mean hourly velocity of 13.19 miles. The highest velocity was 60 miles an hour on the 9th.

Mean height of barometer, 29.040 inches; at 7 a. m., 29.077 inches; at 2 p. m., 29.005 inches; at 9 p. m., 20.032 inches; maximum, 29.417 inches, on the 2d; minimum, 28.675 inches, on the 14th; monthly range, 0.742 inches.

Relative Humidity.—Mean for the month, 69.9; at 7 a. m., 77 9; at 2 p. m. 55·78; at 9 p. m., 76.06; greatest, 100, on the 26th; least, 21.5, on the 3d, There was no fog.

MISSOURI WEATHER SERVICE, JUNE, 1879.

BY F. E. NIPHER, WASHINGTON UNIVERSITY, ST. LOUIS, MO.

The temperature of this month has been below the normal, the monthly mean at the Central Station being 73.6°, or 1.1° below the average of 42 years. The extremes were 93° and 49.5°. In 1870 a maximum of 101.5° was observed and in 1838 and '39 the minimum reached 43°. The rainfall was 3.86 inches. A deficiency of about 0.39 inches. The total deficiency for the past six months of 1879 is 9.58 inches. The month has been remarkable for the distribution of the rainfall, as the accompanying map shows. The greatest precipitation occurred at Miami, and the fall diminished rapidly toward the west, south and east. The rainfall at Macon was but 5.56 inches; the observer there reports that on the 26th 0.23 inches only were recorded, while at a distance of three miles very heavy showers fell. Heavy local storms occurred at Centerville and Ironton on the 1st, and at Greenfield on the 23d, 24th and 25th. The heaviest single rain is reported from Lexington, 3.35 inches falling in nine hours. Several thunder storms are reported from the eastern and southeastern districts on the first, from the central, northwestern, southwestern and eastern districts on the 13th and 14th, and especially from the northern and western districts during the last decade, although heavy rains were observed throughout the State between the 22d and 29th almost daily. At Oregon, on the 13th, a storm destroyed a brick church, and carried the roof a distance of 200 yards; many bridges in the county were washed away. A Mexico, a thunderstorm on the 24th, accompanied by hail, destroyed trees,

and carried a 1½ story house 60 feet destroying it entirely. An aurora was seen at Boonville on the 18th. Notwithstanding the protracted dryness in the north-eastern patt of the State, the crop reports from that section are more favorable than during last month; peaches and apples are poor. Good crops are reported from the eastern and central districts.

METEOROLOGICAL SUMMARY FOR JUNE, 1879.

SIGNAL OFFICE, LEAVENWORTH, KANSAS, JULY 1, 1879.

The past month was noticeable for the high mean temperature, severe local and frequent thunder storms and heavy rainfall.

The mean barometer of the month was 29.871, which was slightly above the June mean. It was the highest June mean since 1872, when it was 29.910. The daily ranges during the month were very slight. The highest reading during the month was 30.288, on the 2d; the lowest 29.456, on the 14th.

The mean temperature of the month was 73.35°, just one degree below the normal. The highest temperature of the month was 93°, on the 9th; the lowest 46°, on the 2d. The mean and maximum were each about 2° above the mean and maximum of June, 1878. The greatest daily range was 32° on the 3d; least daily range 4.5°, on the 25th.

The mean percentage of humidity was 66.28. The average is 65.95%. The greatest daily mean was 84.3%, on the 22d and 27th; the least daily mean 39.3%, on the 4th.

The total rainfall during the month was 9.90 inches. With the exception of June, 1877, (the total that month was 10.00 inches) this was the heaviest June rainfall in eleven years past. The amount which fell on the 27th was 3.43 inches, which was unprecedented in the records of the Station. The June average is 5.38 inches. The annual average of the past 7 years has been 38.50 inches.

The prevailing wind of the month was south. Total number of miles traveled, 5,752. Highest velocity, 48 miles, from the south at 7 p. m., 9th. The direction of the wind was recorded 210 times as follows: N., 29 times; N. W., 19 times; W., 7 times; S. W., 5 times; S., 63 times; S. E., 60 times; E., 18 times; N. E., 4 times, and calm, 5 times.

Number of clear days, 3; fair days, 18; cloudy days, 8, and days on which rain fell, 13. There were 10 thunder storms during the month.

A well-defined solar halo was observed on the 30th, at 11 a. m.

The following extracts are given as being of interest at present. Dr. Tiffin Sinks, in a "Report on the Climatology of Kansas," published in 1866, states that, "The June mean temperature at Fort Leavenworth, compiled from observations extending over a period of thirty years, was 71.31°. The mean of the summer months was 74.05°. The highest temperature ever observed in that time was 108°; the lowest, —30°."

"The average annual rainfall for 30 years was 31.34 inches. Average of summer months, 13.03 inches. The June average is not given. The greatest amount of rainfall observed in one year was 59 inches, in 1858; the least amount in one year, 16 inches, in 1843. The total amount that fell during the summer months of 1854 (the year of the great drought) was 5.70 inches."

In the Kansas Magazine for June, 1873, Prof. F. Hawn, in an article on "Influence of Forests on Climate," says:

"In each year since 1865 the rainfall exceeded the mean of 34 years. The annual mean of the 7 years since 1865 was about 36.50 inches, yet this increase has not extended to the winter, with the snow water included."

"It should not, however, be overlooked that the period in which this excess has accrued is too short to give a definite expression of the results, as we may be on a cycle favorable to the production of increased rains, which may soon close."

"The rain line in Kansas is moving westward, the result of physical causes and the order of natural selection, extending a more exuberant vegetation over the eastern margin of the great arid plains."

"The total rainfall of June, 1868, was 3.76 inches.
" " " " 1869, " 5.10 "
" " " " 1870, " 3.57 "
" " " " 1871, " 5.90 "

The following table shows the mean barometer, temperature and humidity, total rainfall, maximum and minimum temperatures and highest and lowest barometer of June for the past seven years, also the June averages for the same period:

YEAR.	Mean Barometer.	Mean Thermometer	Mean Humidity.	Total Rainfall.	Maximum Temperature.	Minimum Temperature.	Highest Barometer.	Lowest Barometer.
. . . .		deg's.	per c't.	inches.	deg's.	deg's.		. . .
1872	29.910	77.25	60.74	4.75	95	60	30.360	29.320
1873	29.840	75.50	67.20	3.15	97	57	30.107	29.540
1874	29.843	77.40	69.50	4.96	96	50	30.185	29.489
1875	29.851	76.70	58.80	3.85	99	48	30.215	29.480
1876	29.831	71.20	66.00	5.71	95	46	30.130	29.472
1877	29.828	71.90	70.10	10.00	93	45	30.067	29.431
1878	29.863	71.50	69.30	5.27	91	49	30.151	29.510
1879	29.871	73.35	66.28	9.90	93	46	30.288	29.456
Average of 7 Years.	29.852	74.35	65.95	*5.38	95	51	30.174	29.463

* By adding the observations of Prof. Hawn from 1868 to 1871, inclusive, the June average is reduced to 5.09 inches.

SAMUEL W. RHODE,
Signal Corps, U. S. A.

WEATHER REPORT, SUMMIT, COLORADO, JUNE, 1870.

BY PROF. C. B. ROBINS, V. O.

Highest temperature, 62+°; lowest temperature, 28+°; mean temperature, 42.6+°; mean of maximum temperatures, 55.1+°; mean of minimum temperatures, 35.9+°; total snowfall, one-half inch; rainfall on three days, not enough to measure in gauge; prevailing wind, west; maximum velocity of wind 20 miles an hour; number of days on which snow fell, 3; number of cloudy days, 3; number of fair days, 4, number of clear days, 23. June 24th, first rainfall of 1879, mingled with snow. June 16th, snow from cloudless sky.

During most of the month the atmosphere has been filled with smoke and ashes from two extensive forest fires west and southwest of us, and from ten to twenty-five miles distant. The conflagration west is advancing rapidly this way under a strong gale, but as two mountain ranges with summits above timber line intervene, no apprehension is felt here. These fires have been burning continuously for two months, the amount of timber destroyed is very large. Everything is exceedingly dry.

COMPARATIVE SNOWFALL DURING WINTERS OF 1876–7, 1877–8 AND 1878–9, AT SUMMIT, COLORADO.

1st September, 1876, to 1st July, 1877	235.67 inches.
1st September, 1877, to 1st July, 1878	245.82 "
1st September, 1878, to 1st July, 1879	148.68 "

The snowfall in 1878–9 was less than in 1876–7 by 137 inches, and less than that in 1877–8 by 97.14 inches; or, 52% of that in 1876–7, and 62½% of that in 1877–8 = 56% of that in the two previoas years averaged, or 44% below their average.

GEOLOGY AND PALÆONTOLOGY.

ANOTHER VIEW OF THE ANTIQUITY OF MAN.

BY PROF. B. F. MUDGE, MANHATTAN, KANSAS.

We were much interested with the article in the June number of the REVIEW, on the Antiquity of Man, by the Rev. J. L. Templin. He has very clearly and fairly stated the facts in the case, though we think he has left the question of the age of our race, in years, too indefinite.

We agree with him (and Dana) that man was on earth "at the close of the glacial epoch, that he witnessed the retreat of the glaciers from Central Europe,"

etc., etc. After the glacial epoch, geologists fix three distinct epochs, viz: the Champlain, terrace and delta, which have been considered of nearly equal lengths. The question then arises, have we no evidence to show the length of either of these periods?

There are facts which circumstantially give us a near approximation of the age of each, but they are nearly all based on considerations which only an expert geologist can appreciate. There are, however, in the delta period of the Mississippi, proofs which will give a very close approximation, in years, to the length of that epoch.

Various estimates have formerly been made for the time of the delta period, with varied results, Lyell and others placing it at least at 100,000 years, and others making it less. Farther researches, extensively made, have confirmed Lyell's estimate. The most reliable evidence is as follows: For a distance of about two hundred miles of the delta are seen distinct forest growths of large trees, one over the other, with interspaces of sand; showing distinct periods of the entire destruction of the forests; and after burial, again a new generation of trees over the others. There are ten of these distinct forest growths, which have begun and ended, one after the other. The outstretched, undisturbed position of the roots of the trees, as well as the other conditions of the deposits, show that they were not washed in, but grew on the spot.

Now if we can fix the time occupied by the life of these trees, we can give, at least, an approximate result. Fortunately the data are clear and can be studied by any person of ordinary intelligence. The trees in question are the bald cypress (*Taxodium*) of the Southern States, one of the largest and longest of life of the world's trees. Specimens cut down in the present age are known to be from 5,000 to 7,000 years old. Humboldt saw one in Mexico of extremely large size, which he estimated—from counting the rings of smaller trees of the same species—to be eight thousand (8,000) years old.

Such are the trees found in these old, buried forests of the delta of the Mississippi. Some of the old trunks were over twenty-five feet in diameter. One contained over 5,700 annual rings. In many instances these hugh trees have grown over the stumps or fallen trunks of others equally large. Such instances occur in all, or nearly all, of the ten forest beds. Dr. Dowler, one of the best physicians and scientists of New Orleans, saw such instances in many places, and concluded that each of the ten forest growths contained, on the average, two such trees of 5,000 years each, living in succession. This gives to each forest a period of 10,000 years. Ten such periods give 100,000 years, without considering the time covered by the intervals between the ending of one forest and the beginning of another. The thickness of the intervening sand shows that this interval was not, in most cases, a short one.

Such evidence would be received in any court of law as sound and satisfactory, where common sense evidence is used. We do not see how such proof is to be discarded when applied to the antiquity of our race. If the antiquity of the mas-

todon was in discussion no one would doubt it. Human bones have been found in the fifth forest bed, and stone implemenis still lower. As Rev. Mr. Templin has stated, there is satisfactory evidence that man lived in the Champlain epoch. But the terrace epoch, or the greater part of it, intervenes between the Champlain and delta epochs, thus adding to my 100,000 years. If only as much time is given to both those epochs combined as to the delta period, 200,000 years is the total result.

There are other evidences in Europe, generally clear to the geologist, which sustain this long time for the antiquity of man.

ARE BIRDS DERIVED FROM DINOSAURS?

PROF. B. F. MUDGE, MANHATTAN, KANSAS.

We hear, repeatedly, that the Dinosaurs are the ancestors of birds, or the stock from which the latter have been derived by evolution. A few points of resemblance, first noted many years ago, have been constantly repeated, without considering the numerous other points of dissimilarity which a more thorough knowledge of new genera and species has afforded. The fact that the bones of the hind feet of a few species closely resemble those of birds, and some of the bones were hollow, gave rise to the hasty conclusion that other resemblances would be found, and that the bird was the outgrowth of the reptile. While a few foreign species have three toes, like the bird, some of the European and nearly all of the American, have four and five toes, and the structure, and number of bones to the toe are closely reptilian. When there is a divergence from the reptilian type the feet approach the mammalian structure more than that of birds. This is seen in the numerous species and genera of the Sauropoda. In all cases, also, where there are but three toes, and those in structure are like the birds, the other bones of the foot and leg do not approach the type of the birds. When four toes are seen in the dinosaur, the fourth never turns backward like that of the bird. That most characteristic bone in the bird—the tarso-metatarsus—is, in the dinosaur, represented by the usual number characteristic of the reptiles, namely, five to eight bones instead of one; and in no case is there a tendency to consolidate. The tibia and fibula of birds are consolidated, while in the dinosaurs these bones are always separate.

It will be seen that if the legs of the dinosaur tended to a development toward the bird structure, this development is not harmonious, as it should have been; but in the few cases where the toes are bird-like, the other bones of the foot and leg show no such tendency.

Following the structure of the skeleton further, we find the pelvic bones of the bird always consolidated; those of the dinosaur never. Except in a few cases these bones are very different in shape. The termination of the caudal vertebra of the dinosaur is always small and does not tend toward the plowshare structure of the birds.

A still more marked feature is the want of approximation of the dinosaur to the bird, in the sternum or breast-bone. This, in the bird, is the bone more than any other, which is mostly enlarged and singularly developed. Even in the ostrich and fossil Hesperornis, and other birds without wings, it is a large, massive bone. But in the thirty-five or more genera, embracing more than twice that number of species, of dinosaurs, only two have any trace of a sternum, even cartilaginous. In one European and one American species there is a small, slender, flat sternum, entirely unlike that seen in the bird, very reptilian in its structure. It has no shape that can be simulated to that of the bird. As a necessary result the clavicle (*furculum*), so marked in birds, is also wanting, though a rudimentary one is inferred in Apatosaurus

The differences between the wing bones and those of the front feet of the dinosaur are as marked as in any other portion of the skeleton. If the one had been the outgrowth of the other, then we should have seen an early and more rapid change in the fore foot of the reptile, than in the hind foot, inasmuch as the wing is far different in shape from the foot. But when the dinosaur has but three toes, like a bird, in the hind foot, (losing two from the typical reptile foot,) the fore foot has four toes. When the dinosaur has four toes in the hind foot, there are five in the front foot, all clinging to the reptilian type, and showing no divergence in the shape or structure toward the two closely united fingers of the wing. If the bird were a descendant, by evolution, from the dinosaur, the change of a foot to a wing should have begun early, and the development should have been more marked and rapid than that of the hind foot. But no indications of such change is seen, or the slightest tendency to form a wing, in all the fifty or sixty species of dinosaurs that have been described.

The hollowness of the bones is less a marked feature of the dinosaurs than is usually supposed, and cannot be considered a marked characteristic; as more than half of the genera have no pneumatic cavities like birds, but bones of the solid or medullary structure of mammals. In Camarasaurus of Cope the hollow chambers assume a singular structure entirely unlike that of birds. The long bones are solid or medullary; but the vertebræ, which in birds are solid, have open re-entering cavities, which add lightness and strength, and may have been pneumatic. But the hollowness, such as it is, has no resemblance to that of the long bones of birds.

The articulations of the vertebræ, when not retaining the reptilian traits, are more like mammals than birds. The bird articulation, so peculiar and so persistent, sometimes called "saddle-shaped," is not found in any dinosaur. But in the fossil Ichthyornis (first discovered by the writer in Kansas), a bird in this respect of low type, the vertebræ do not approach any form peculiar to the dinosaurs, but are fish shaped, or bi-concave.

It will thus be seen that, while in a few features there may be some resemblances between dinosaurs and birds, just as there are between the former and mammals, the details of the structure of the skeletons show, as a whole, very wide-

ly different elements. The dinosaurs vary so much from each other that it is difficult to give a single trait that runs through the whole. But no single genus, or set of genera, have many features in common with the birds, or a single persistent, typical element of structure which is found in both.

The geological position of the dinosaurs, too, precludes the idea that they are the ancestors of the birds. They appear at the same time (in the Triassic) as the birds, instead of preceding them, and they continue to the Eocene; and the later specimens do not approximate any nearer to bird forms than the first.

If the birds were derived, by process of evolution, from the dinosaurs, then the latter should have appeared first, and, as geological time progressed, should, harmoniously, in every organ, assume a nearer and nearer approach to the bird type, and finally disappear in the flying biped. When it became a bird, it should have ceased to be a Dinosaur, just as a child disappears in the man. The last one at the close of the Cretaceous, when the type became extinct, had no nearer an approach to the bird than the earliest in the Triassic. Laosaurus, which, of all the twenty-seven American genera, approaches in the toes and pelvis nearest to birds, is found in the Wealden; and, in legs, fore feet, and absent sternum, has no approximation to a bird.

No dinosaur has ever shown a fore foot approximating in the slightest degree to a wing. The first bird was as distinctly a bird, with feathers and wings, as any now living. True, Archæopteryx had a tail of twenty vertebræ, but that is an appendage in common with the lowest reptile and the monkey, and does not ally it to the dinosaurs any more than to those animals. The fossil birds differed as strongly from each other as those now living. The Hesperornis and Ichthyornis lived and ran out together, the one without wings and with a common bird vertebræ; the other with strong wings and a fish-like vertebra. Others lived with them closely allied to living species.

With so little to sustain the evolution of the bird from the dinosaur, can it be accepted as a geological fact?

ASTRONOMY.

OBSERVATIONS OF SWIFT'S COMET, 1879.

PROF. S. C. CHANDLER, JR., BOSTON, MASS.

I herewith send you observations, with elements and an ephemeris, of the comet discovered by Lewis Swift on June 19. The comet was observed by me on four evenings; on two of these good determinations of position were obtained with a ring micrometer on a 3-inch Clark refractor. On the other evenings the

best I could do was to make careful allineations of the comet with the telescopic stars in the field; and a careful reduction of these has furnished positions which are probably less than a minute of arc in error. I append them with the micrometer observations, as they may prove to have some value.

Boston Mean Time.				Apparent Place. A. R.			Decl.			
d.	h.	m.	s.	h.	m.	s.	°	′	″	
June 25	10	15		2	49	40	+68	50		By allineation.
26	13	49	12		50	19.7	+69	59	8.2	3 obs. with ring microm.
27	12	20			50	46	+71	1		By allineation.
30	14	22	12		52	30.7	+74	21	10.6	3 obs. with ring microm.

In these observations I was kindly assisted by Mr. J. C. Howard.

From the above positions of the 26th and 30th, combined with one made on the 23d by Prof. Hough, at Chicago, as follows:

June 23d, 11h. 47m. 0s A. R 2h. 48m. 43.6s Decl. +66° 50′ 54″,

I have calculated the orbit, and I append the elements, and also a finding ephemeris.

Elements.

Perihelion Passage, 1879, May 20.2115. Washington Mean Time.

	°	′	″	
Long. Perihelion,	11	35	25	Mean Eq. 1879.0.
Long. Node,	56	4	0	
Inclination,	70	38	3	

Log. Perihelion Distance, 0 09482.
Motion, Retrograde.

The orbit does not resemble that of any known comet.

Ephemeris for Washington, Midnight.

1879.	A. R. h.	m.	s.	Decl. °	′	log. r.	log. Δ
July 7.	2	57	20	+82	23		
9.		58	57	84	49	0.1644	0.1905
11.	3	2	25	87	18		
13.	4	5	30	89	48	0.1737	0.1860
15.	14	54	0	87	39		
17.	14	58	11	85	6	0.1833	0.1839
19.	15	0	0	+82	31		
21.		2	3	79	56	0.1930	0.1844
23.		3	29	77	21		
25.		4	55	74	47	0.2028	0 1877
27.		6	20	72	14		
29.		7	47	69	42	0.2126	0.1935
31.		9	10	67	14		
Aug. 2.		10	33	64	45	0.2225	0.2019

Between the 13th and 14th of July the comet will pass nearly over the celes-

tial pole, which is the cause of the abrupt change of about 12 hours in right ascension in the ephemeris.

Although the comet will slowly approach the earth until the 17th of July, it will become no brighter, since it is receding from the sun more rapidly. The relative brightness, as indicated by the reciprocal of the square of the product of the distances from the sun and earth, is as follows:

June 19,	1.90.	July 17,	1.84.
25,	1.95.	25,	1.66.
July 1,	1.98.	Aug. 2,	1.42.
9,	1.95.		

Although easily seen with 3 inches aperture, the comet is difficult to observe with the micrometer on a telescope of that size. It has an oval disc about 5 minutes of an arc in diameter, and its light is considerably condensed toward the center.

It may save computers trouble to mention an error in the *American Ephemeris* for 1879, p. 393; sun's true longitude for July 1.0, minute should be 25, not 26

—[*Science Observer*.

VISIBILITY OF THE CORONA IN FULL SUNLIGHT.

PROF. ORMOND STONE, CINCINNATI OBSERVATORY.

I have been much interested in the discussion which took place at the March meeting of the Royal Astronomical Society in regard to the visibility of the corona. In this connection permit me to say that Mr. Upton, who observed the late eclipse of the sun with me at Schuyler, near Denver, Colorado, saw the moon's limb five minutes eight seconds before the beginning, and seven minutes and thirteen seconds after the end of totality. I myself saw the coronal rays distinctly for twenty-three seconds after totality had ended. A flood of light then suddenly filled the field of my telescope, and the rays could be no longer distinguished, although the moon's limb was sharply defined. I have no doubt that if I had moved the telescope so as to throw the limb of the moon to the edge of the field I should not have been disturbed so soon by the sunlight, and might have seen the coronal rays at least some seconds longer.—*London Observatary*.

POLITICAL SCIENCE.

BRITISH IMPERIALISM AND THE AUTONOMOUS RIGHTS OF RACES.

BY A. H. THOMPSON, TOPEKA, KANSAS.

With the advent of the present year the civilized world was again summoned to the contemplation of, and, if charitably minded, to applaud and sanction, the exhibition of a fresh sample of British Imperialism, in the descent upon Zululand. The actual occasion of this war appears to have been the growth of the South African Empire, the demand for more land making it expedient to take and annex more territory; cause for quarrel with neighboring native nations being easily made, and war being inevitably followed by conquest and annexation.

In commenting upon the disaster to British arms with which the campaign against King Cetywayo and the Zulus was inaugurated, the *Times* states that Lord Beaconsfield "is avowedly devoted to what is now well known as 'Imperialism,' that is to say, to a system under which the people are to submit to a course of secret policy directed to objects of conquest and aggrandizement few of them would approve," and the actions and policy of the Tory Premier and his tools, his "Jingoism" and his "Jingos" are roundly censured. But we outsiders, having "cut loose" from the Mother Country, and pursuing a path of action and thought essentially free and original, have little sympathy with British party jealousies and asymetrical patriotism, and the conventional differences between the "ins" and the "outs." To us it has appeared as if the English nation has pursued this same policy under any and every administration; that the conquest and enslavement of weak peoples has been an hereditary policy for centuries, whether under Tory or Liberal government. In the case of the doomed Zulus the purpose of attack was ill-concealed, though cloaked under a cause and quarrel itself purposely provoked and created.

In view of these facts and of the invasion of Zululand, it again becomes the duty of the friend of wild and simple peoples to protest against the policy of the conscienceless destruction of weak and friendless nationalities for the mere selfish purpose of the acquisition of territory and the practical, if not the nominal, enslavement of the poor defenseless natives. We cannot but arraign the lust for gain of the whole British people as the popular basis of the policy now called "Imperialism," and wish that British statesmen could rise above the vulgar avarice of the masses and teach the people a sense of the common duties of humanity and the obligations of common brotherhood, and that nations are under moral obligations to each other as well as individuals. It is the old spirit of "trade" and "commerce" regardless of the infringement of popular rights or the infliction of

individual suffering, and as "might makes right" the poor savage must succumb to the power of the "nation of shopkeepers," which needs more markets and more producers. This nation is in immediate need of more land and more slaves to cultivate it, in order to the support of her increasing classes of non-producers, her ornamental aristocrats and hangers on. More territory must, in consequence, be annexed, more wild people must be enslaved to cultivate the land, to the end of paying more taxes, making more revenues and creating more markets for British manufactures.

The protection which England professes to bestow upon wild and weak people is a poor return for national enslavement, the grinding taxation which crushes out the spirit and happiness of a people is not compensated for by the protection supposed to be afforded to life and property. The defense of her actions and her avarice is the transparent apology of carrying the blessings of civilization to savage people, and that she makes them happier by preventing bloodshed and cruelty, by conferring Christianity and educating them in the ways of western nations. But while she is justified in restraining evil passions and preventing tribal wars with their attendant miseries, she is not justified in committing the same or equivalent crimes for the purpose of complete political conquest and subjugation. All the world knows that it is the same old motive, the same that actuated Cortes and his band of heroic murderers in the conquest of Mexico. They fought, deceived and subjugated the valiant Mexicans in the name and by the authority of the cross; they filled their chests with the poor Indian's gold, took his lands, slew him and enslaved his children, and compensated the survivors for their outrages by forcing upon them a religion. The Spaniards there and elsewhere acted upon the ultra-principle, that the need of a people to the blessings of the gospel, stood in exact ratio to the amount of gold or fertile lands they possessed, and that the religion the conquerors brought with them and inflected upon the conquered was a fair equivalent for wholesale robbery, murder and enslavement. The spirit which actuates British conquest is precisely the same, for while England has been, perhaps, on the whole, more humane than Spain, she has pretended that her dominion over savage people was merely for their own good, when the real motives, as all the world knows, are avarice and aggrandizement of British territory, wealth and power.

It is now three hundred years since the conquest of the rich native races of America, *because* of their wealth in gold or land, but in all that time the great Christian nations of the world have grown but little better in their treatment of weak neighbors. They have yet to acquire and understand that moral sense of right which recognizes that the claims of weak nations to independence, be they savage or civilized, are as just and weighty and entitled to as much consideration by strong powers as the claims of the latter to the same prerogative; and that autonomy is not an exclusive and peculiar privilege, depending upon the might of the nation which assumes it to maintain and defend it, but that it is a fundamental and primative right, hereditary in a race, and possessed by reason of racial and

well marked ethnical distinctions. The nineteenth century is vain of its civilization, so called, and of the moral height attained in the enforcement of justice and fair dealing between man and man; but we yet behold in all its primitive, savage simplicity, the *un*civilized spectacle of nations acting toward each other according to the principles which govern the intercourse of the lowest savage men, as in the infancy of the race, or of wild animals; *i. e.*, the undisputed *right* of *might*, and the privilege of one nation to conquer, crush and enslave another—*if* it can do it. But we are unjust to the animal world, for some of them are charitable towards their weaker neighbors and do not destroy them merely because they can. No such natural moral code obtains between nations, however, for they would conquer and destroy each other like madmen, if they could. We are the contemporary witnesses in this pharisaical nineteenth century of great nations, like England and Russia, irritating and insulting their weaker neighbors, who, having the temerity to resent wanton injury and resist encroachment, are immediately crushed and absorbed. The "honor" of the bigger animal must be vindicated and avenged by the destruction of the smaller. We might find another illustration and analogy in the dealings of children with each other, who, as is well known, represent in the various phases of their mental and moral development, the many stages through which our species has passed in the process of evolution from lower to higher types. The big boy covets the toy of the small boy; he picks a quarrel with him by an insult which the small boy cannot help but resent, whips him because he resents it and acquires the toy on a predetermined result of the controversy. How painfully like the actions of great nations toward the smaller. In the primitive age, the childhood of the species, we know that the same principle prevailed; might made right, and if one individual desired what another possessed, he took it if he could and murdered the owner. Reasoning from the analogy, we cannot but conclude that the code of international morals is yet in its incipiency, "without form and void," and that the progress of the development of the principles of justice and right between nations and races has not kept pace with their growth as between individuals. The fair and just treatment of individuals by each other has been brought about by the evolution of laws, enacted and enforced by a central power, called the government, for the common good of the mass of the people; sometimes, of course, to the detriment of individual success in acquiring fortune or power by restraining selfishness.

The universal tendency of the individuals of all nations to revert to the conditions of barbarism and the rule of brute force immediately on the absence of law, has been amply demonstrated, as in the case of remote colonies, or new settlements and similarly circumstanced conditions. The forcible control of individual action is imperative even in the most highly cultivated and civilized countries. This is a sad comment upon our boasted civilization and morality; but it is none the less true that we must yet be restrained by force and the fear of punishment from murdering and plundering each other. But yet these natural, animal propensities which are controlled in individual dealings, are given full sweep in

international affairs, apparently for the reason that there is no interfering, stronger power—at least none which they recognize as to which they render allegiance—which will hold them accountable and punish wrong doing. Might seems to make right and differences are adjusted by the simple demonstration as to which one of the contestants possesses the superior strength—just as in animal nature.

And it is painful to contemplate that the great, the powerful, the civilized, the aggressive nations of the earth to-day are *Christian* in religion—a creed which teaches love, charity, benevolence, forbearance and brotherly kindness toward our fellow men! We are taught by the example of *these* nations—strong and powerful by reason of their civilization and intelligence, the professors of Christianity—that *weak* nations—peoples weak by reason of their ignorance and mental and moral depravity and superstitious—have no rights, because they are weak, which the stronger nations are bound to respect! Their actions are in direct conflict with the principles of the religion which they so loudly profess, and the candid man must brand them as national hypocrites and knaves. Amongst others, England has many sins to atone for in this respect, but one of the most flagrant wrongs, one of the most shameful employments of power, was in the forcing of China to admit the opium of India, to the detriment and moral ruin of her people, in order that India might have a market for the soul and body destroying commodity, and Englishmen amass wealth from this ill-gotten gain! This great national crime should be clamored in the ears of England until she redresses the wrong or repudiates her Christianity and becomes consistent at least. Nations are more shameless in their inconsistency with their professions of religion than individuals, which is saying much for national immorality.

The poor Zulu nation is the last, up to date, of the long line (not yet terminated) of the victims of British arrogance and avarice. The Zulus naturally and and patriotically resented the claims and arrogant demands of England, which they and all the world knew meant merely conquest and absorption, peaceably if possible, forcibly if necessary. At last their gallant chief, goaded into resistance, repelled invasion and was successful in the first conflict. Of their victory all friends of wild people and of the principle of racial autonomy were heartily glad, regretting only the cruelty with which it was attended. We could only wish that the chief had had the wisdom to push his success before reinforcements could have reached the British, and the policy to skirmish and raid without cruelty, and thus crowd the British commandant into an acknowledgment of Zulu independence and the definition of a compromise boundary line. But his savage ignorance was his ruin and he and his unfortunate people must suffer defeat, destruction of nationality, absorption and slavery. "British honor has been insulted" by the heroic defense of primitive rights by a simple people, and they must be crushed that British "honor" (?) be avenged. The big animal irritated the little animal into resenting wanton insult and the big animal's honor must be vindicated by whipping and eating the smaller. The weak nation has risen in its patriotism to fight in defense of homes and national life and its resistance, is, forsooth, a crime,

because directed against *British* arms! Patriotism has been counted a cardinal virtue from classic ages, and the Briton of to-day thinks his life a small sacrifice when offered in defense of British honor. Is patriotism any less a virtue in a savage, and why? If he defends his country against British assault, why is his patriotism criminal? It is simply the spirit of Cortes and the conquerors, who dubbed the patriotic resistance of the Mexicans "rebellion" and punished it with death or slavery. In the Spaniard of the sixteenth or the Englishman of the nineteenth century it is simply the childish national *Ego*, which arrogates everything and every virtue to itself and denies, unreservedly, everything, every right or claim to others—especially the weak.

England is, of course, bound now to continue the war with and defeat the Zulus, because of the national disgrace of the defeat of arms, when she can undoubtedly do so, but the avenging of that insult does not warrant the conquest and absorption of the entire Zulu domain. In all common justice and honesty, the conquerors have no right to annex another country to their own merely because they can. Such a transaction between individuals is called robbery, crime, felony; and with nations it would seem that, as O'Connell has well said, "nothing can be politically right which is morally wrong." Yet nations have committed this crime since time began, unless prevented by the united protest or armed interference of other countries, as in the case of European states, where mutual interest, and, in some cases, friendship, has prevented extensive conquest by any one country, as all are interested in the distribution of power. But the poor Zulus are a wild and savage people with no friends to interfere in their behalf and no rights a *civilized* country is bound to respect. The octopus arms of the destroyer are already fastened upon them and there is no escape from the deadly grasp but in national death. The material existence of the nation will soon be crushed out, and they, like the millions gone before, will labor, suffer and die that Britain may be rich. And the octopus arms, insatiable, will reach still on and on, grasping, strangling, enslaving, killing!

But let us hasten to create another picture, more pleasing than the first; let us present a contrast to the existing state of international morals. Let us suppose that the civilized and powerful nations of the world would break away from their shameful precedents and adopt and inaugurate a new system in their dealings with each other and with weak and savage peoples; a system of justice and right, such as they enforce between individuals; which should demand that the strong and rich powers should protect and care for the poor and weak nationalities and races; that the ignorant and indolent among nations should be educated and elevated in mind and morals, and be taught honest self-support and self-government; that the vicious and cruel should be restrained and controlled and by education be lifted above the practice of vices natural to man; and, in brief, that all nations should put into practice in international dealings that theory of brotherly love and the recognition of natural rights between nation and nation, as well as between man and man, which is the sum and substance of that Christianity which so many

of them boast of and so few of them practice. Under such a rule the world would, indeed, be a paradise, and the attainment of such a condition of things is not impossible, nor the idea so Utopian or impracticable as at first appears. Let us detail:

The central principle of our system is this: That it is not too much to assume that the racial, ethnical line of distinction between peoples should be the national line; that where the races divide the nations should divide; that a nation should be comprised of one race or sub-race, and one only; that the right of races to autonomy, independence, self-government is as sacred and natural as that of an individual to life and freedom, and that the prerogative is inalienable by reason of inherited privilege and ethnical distinctness. Races and sub-races are sufficiently marked and individualized as to render them readily distinguishable, and this line of radical distinction should be the national line. Every race is distinguished in a marked manner from every other race, by physical and mental peculiarities, customs, government, etc., and such peculiarities we assume to be indicative of the right to independence. Even the weak races, by reason of their distinctness alone, should be considered as being just as much entitled to the sacred prerogative of independence and self-government as the strong races, and in the name of suffering and oppressed humanity, and of Christianity, it is high time that the latter unite and form compacts and agreements to bear and forbear, to restrain themselves and others, and prevent useless destruction by strong and unscrupulous powers, who kill merely because they can.

(To be continued.)

MEDICINE AND HYGIENE.

HOT WEATHER HINTS.

J. R. BUCHANAN, M. D.

The fatality of the hot season, especially to children, is well-known, and this, with the immense sums expended by city people in seeking summer retreats, gives high importance to the question how we can best manage the hot weather.

The proper management should be both preventive and curative. As a curative measure I advise my friends to take from five to ten drops of dilute phosphoric acid (which can be cheaply obtained at any druggist's) in a glass of sweetened water. This can be repeated as often as necessary, but I would not recommend any one to use more than sixty drops, or a teaspoonful, in twenty-four hours. This is a cooling tonic and restorative to the system. Under its use the hot weather soon ceases to be intolerable, and its exhausting effects disappear. This

is real "brain food," but it would restore many a drooping invalid to health by a pleasant phosphoric lemonade.

For the children who are passing away by the summer complaint there has never been devised anything better than the old "neutralizing cordial," which has been in use for fifty years, but which is not as well known in New York as in other cities. It is a preparation of equal parts of peppermint plant, rhubarb, and saleratus (bicarbonate of potassa, not soda), made into a cordial with loaf sugar and brandy (or alcohol), and sometimes improved by an addition of cinnamon. It is the most harmless and perfect agent for the treatment of diarrhea, ever invented, and may be given to the youngest infant with impunity. Twenty drops for an infant, and two to four teaspoonfuls for the adult, may be repeated at intervals of four or five hours until relief is obtained.

But the important management to which I beg the attention of the *Sun's* readers is the preventive. In the first place, if the ailantus nuisance were exterminated and our shadeless streets lined with elms and maples, our windows protected by awnings, and our houses by creeping vines and verandas, and our roofs by non-conducting lining, we should not have much to complain of. Still we are not without resources.

Every house should be open to the night air, and closed against the heat of day. The upper sash of every window should be lowered all night, and every trap-door or inner door of the house should be open for ventilation. The higher the windows the more necessary it is that they should be opened, as the hot air accumulates in the upper part of the house. All garret windows and doors should be kept open habitually, and on hot nights a few buckets of water should be expended from a watering-pot in watering the roof and the garret. The hanging of wet sheets and clothes in the garret contributes to the cooling of the house.

To those who have a few dimes to spare it is perfectly easy to secure as cool a residence in the heart of a city as can be found on the sea-shore or the mountains, and it would certainly be folly for delicate invalids to run away from the comforts and kindness of home to escape the heat, when the home can be made as cool as the mountain top.

By repeating the precautions already mentioned, our houses ought not to rise above 80° in their interior temperature. My own office has not been above 80° this season. By the proper use of ice the interior of our houses can be kept throughout the summer as cool as any one could desire. From 65° to 70° is a delightful summer temperature. Few would desire it as low as 60°. To maintain this temperature requires only the use of a sufficient amount of ice to absorb the excess of caloric above 65°. If the air in the house has risen to 85° (and it ought not to be allowed to rise above 80°) the abstraction of 20° would be required. This for a room fifteen feet square and ten feet high would require (as the specific capacity of air is to that of water nearly as 1 to 4), between six and seven pounds of ice. If the entire area of a house is equal to ten such apartments, about sixty-five pounds of ice would reduce its air in summer to 65°. But if the

house has been cooled by night ventilation to 70°, then from sixteen to twenty pounds of ice would complete the cooling.

The way to effect the cooling would be to place the ice in metallic vessels in the highest part of the house, over its halls and stairways, while the doors and windows are closed to keep out the warm air.

As the house I have supposed would contain from 1,800 to 2,000 pounds of air (unless very largely filled with furniture), the quantity of ice required to cool this amount is not the limit, for in the middle of summer the walls have also become heated, and the supply of ice will have to be doubled until the walls and furniture have become cool, and an additional supply will be required if there are many gas-lights, or if the heat of the kitchen is allowed to ascend into the halls and apartments. But at the beginning of warm weather, or after the house has been well cooled, the calculations I have made will be applicable. Probably 60 to 100 pounds of ice daily, if properly managed, would make the average brown stone house of New York comfortably cool.

For the invalid it will be indispensable to cool the whole house. A tin bucket filled with ice, and supported or suspended near the ceiling, or above a wardrobe would be a very economical way of getting the coolness of mountain air. Of course, if the doors and windows are opened it will require more ice.

This coolness will be especially refreshing in sultry weather, when the heat is most oppressive, bringing delicate persons almost to the verge of sunstroke; for the ice condenses the moisture and dries the air of the apartment. Hence in sultry weather more ice will be required than in dry weather, but its beneficial effects will be more marked.

In commending this hygienic plan to the medical profession I would add that it will greatly reduce the mortality of fevers and of all diseases that are aggravated by hot weather. It is their duty to demand that invalid apartments shall be kept down by ice below 65° of temperature.

If hospitals, quarantine stations, and pest houses were cooled by ice, as I suggest, the expense would probably be saved in the diminished consumption of drugs and the smaller number of funerals. But, without regard to pecuniary considerations, the check given to infection, the diminished mortality, and the vast reduction of suffering are imperative reasons for cooling by ice.—*N. Y. Sun.*

NEGLECT OF THE EYE.

BY DR. EDWARD G. LORING.

Whatever an ounce of prevention may be to other members of the body, it certainly is worth many pounds of cure to the eye. Like a chronometer watch this delicate organ will stand any amount of use, not to say abuse, but when once thrown off its balance, it very rarely can be brought back to its original perfection of action, or, if it is, it becomes ever after liable to a return of disability of function or the seat of actual disease. One would have supposed from this fact, and

from the fact that modern civilization has imposed upon the eye an ever-increasing amount of strain, both as to the actual quantity of work done and the constantly increasing brilliancy and duration of the illumination under which it is performed, that the greatest pains would have been exercised in maintaining the organ in a condition of health, and the greatest care and solicitude used in its treatment when diseased. And yet it is safe to say that there is no organ in the body the welfare of which is so persistently neglected as the eye.

I have known fond and doting mothers take their children of four and five years of age to have their first teeth filled, instead of having them extracted, so that the jaw might not suffer in its due development and become in later years contracted, while the eye, the most intellectual, the most apprehensive, and the most discriminating of all our organs, receives not even a passing thought, much less an examination. It never seems to occur to the parents that the principal agent in a child's education is the eye; that through it it gains not only its sense of the methods and ways of existence of others, but even the means for the maintenance of its own; nor does it occur to the parents for an instant that many of the mental as well as bodily attributes of a growing child are fashioned, even if they are not created, by the condition of the eye alone.

A child is put to school without the slightest inquiry on the part of the parent, and much less on the part of the teacher, whether it has the normal amount of sight; whether it sees objects sharply and well defined, or indistinctly and distorted; whether it be near-sighted or far-sighted; whether it sees with one or two eyes; or, finally, if it does see clearly and distinctly, whether it is not using a quantity of nervous force sufficient after a time not only to exhaust the energy of the visual organ, but of the nervous system at large.—*Harper's Magazine for August.*

YELLOW FEVER PRECAUTIONS.

The Executive Committee of the National Board of Health invites the attention of all state and municipal authorities and sanitary organizations to the fact that they should without delay endeavor to secure the best sanitary condition of places and people under their charge, and whatever opinions may be held as to causes of yellow fever and of the recent appearance of that disease in Tennessee and Mississippi, to act as if it were a disease due to a specific particular cause which is capable of growth and reproduction, transportable, and may be destroyed by exposure to a temperature above 250 degrees Fahrenheit, or by chemical disinfectants of sufficient strength, if brought into immediate contact. It is also prudent to assume that the growth and reproduction of this cause are connected with the presence of filth in the sanitary sense of that word, including decaying organic matter and defective ventilation as well as of high temperature. The cases of yellow fever recently observed should be considered as due to causes surviving from last year's epidemic and to recent importation from other countries. It fol-

lows that there is a liability to the appearance of other cases in places visited by the epidemic of last year, and that there is danger of a spread of disease to the north and east.

The object of the present circular is to advise that all cities, towns and villages be at once made clean in a sanitary point of view. The first step toward securing cleanliness is to obtain reliable information as to what parts of places are clean and what foul. The result of careful sanitary inspection in almost any city or town will show the existence of collections of decaying and offensive matter previously unknown, and which every one will admit should be promptly removed and destroyed. Such inspection, to be of value, must be thorough and made by persons competent to recognize foul soils, water and air, as well as the grosser and more palpable forms of nuisance. They should also be made by persons who would report fully and frankly the results of their observations, without reference to the wishes of persons or corporations. When the whereabouts and extent of the evil is known, the remedy is usually almost self-evident. The National Board of Health will furnish, on request, blank forms as a guide for such inspections.

[July 23. The National Board of Health report that their recommendations to the state authorities do not meet with a very general response and that thus far but three states have availed themselves of the facilities and means afforded.—Ed.]

REMEDIES FOR SUNSTROKE.

New York city is threatened with a sunstroke season, and Dr. Jones, of the Board of Health, has issued the following circular, applicable in this city as well:

"Sunstroke is caused by excessive heat, and especially if the weather is 'muggy.' It is more apt to occur on the second, third or fourth day of a heated term than on the first. Loss of sleep, worry, excitement, close sleeping rooms, debility, abuse of stimulants, predispose to it. It is more apt to attack those working in the sun, and especially between the hours of 11 o'clock in the morning and 4 o'clock in the afternoon. On hot days wear thin clothing. Have as cool sleeping rooms as possible. Avoid loss of sleep and all unnecessary fatigue. If working indoors, and where there is artificial heat—laundries, etc.,—see that the room is well ventilated. If working in the sun, wear a light hat (not black, as it absorbs heat), straw, etc., and put inside of it on the head a wet cloth or a large green leaf; frequently lift the hat from the head and see that the cloth is wet. Do not check perspiration, but drink what water you need to keep it up, as perspiration prevents the body from being overheated. Have, whenever possible, an additional shade, as a thin umbrella when walking, a canvas or board cover when working in the sun. When much fatigued do not go to work, but be excused from work, especially after 11 o'clock in the morning on very hot days, if the work is in the sun. If a feeling of fatigue, dizziness, headache or exhaustion occurs, cease work immediately, lie down in a shady and cool place; apply cold cloths to and pour cold water over head and neck. If any one is overcome by

the heat send immediately for the nearest good physician. While waiting for the physician, give the person cool drinks of water, or cold black tea, or cold coffee, if able to swallow. If the skin is hot and dry sponge with or pour cold water over the body and limbs, and apply to the head pounded ice, wrapped in a towel or other cloth. If there is no ice at hand keep a cold cloth on the head, and pour cold water on it, as well as on the body. If the person is pale, very faint and pulse feeble, let him inhale ammonia for a few seconds, or give him a teaspoonful of aromatic spirits of ammonia in two tablespoonfuls of water with a little sugar."

HYDROPHOBIA.

Dr. Francis Quixano, of New York, in a communication to the *Times* makes the following propositions in regard to this terrible disease:

First, that hydrophobia cannot be communicated by a non-rabid dog. Second, that rabies can be originated *de novo* in a female dog as well as in the male. Third, that after the dread of water is once manifested in the human subject the patient cannot swallow liquids or solids, and, therefore, that a good many cases reported as of hydrophobia have been really cases of *traumaticus tetanus*, or of mental hydrophobia. Fourth, that confirmed rabies has a symptom which is not mentioned in most of the medical treatises, and this symptom is not found in *traumaticus tetanus* and mental hydrophobia. Fifth, that genuine hydrophobia kills, invariably, within the fourth day after the first symptoms of invasion. Sixth, that in rabies the human subject is always perfectly rational up to the last moments, never bites nor tries to bite, and doesn't bark. Seventh, that dysphagia, or the impossibility of swallowing, never shows itself as the first symptom of the stage of invasion. Eighth, that curara (not woorara), vapor baths, strychnia and hypodermic injections of morphia and atropia are powerless, even at the first symptoms of the stage of invasion, and that vapor baths, cauterization with lunar caustic, and washing the wound with phenic acid (improperly called carbolic acid), do not prevent the development of rabies. Ninth, that hydrophobia can be arrested if other means are used in time, and even that the patient can be saved if the right remedies are applied at the stage of invasion.

BOOK NOTICES.

EIGHTH, NINTH AND TENTH ANNUAL REPORTS OF THE GEOLOGICAL SURVEY OF INDIANA. By E. T. Cox, State Geologist, assisted by Prof. John Collett and Dr. G. M. Levette. Indianapolis, 1879; pp. 541, octavo.

We are indebted to Prof. John Collett, now Chief of the Bureau of Statistics and Geology of the State of Indiana, for the above named volume. The surveys were made during the years 1876, '77 and '78, and this volume is devoted princi-

pally to detailed reports of the counties of Wayne, Crawford and Harrison, with a general review of the Geology of the State, etc.

The chapters upon the Glacial Drift and Archæology are especially interesting, for Indiana, perhaps more than almost any other State, shows the wonderful results of glacial action, in the immense beds of agglomerated rock, metal, clay and coal, including specimens of all the formations lying to the northward, without regard to their geological age or position, which stretch clear across from Ohio to Illinois, often 50 and sometimes as much as 90 feet in thickness; while in Antiquities she is particularly rich, as the researches of Messrs. Morrison, Sutton, Gerard, Blunt, Sampson and others have demonstrated.

The survey of Indiana is well advanced and is being thoroughly done by the accomplished and energetic men in whose hands it has been placed.

First Biennial Report of the State Board of Agriculture of Kansas. Vol. VI, second edition, 1877–78; pp. 632, octavo. Rand, McNally & Co., Chicago.

We have several times had occasion to refer in complimentary terms to the good judgment and wisdom of the State Board of Agriculture of Kansas in publishing its reports and scattering them broadcast over the country, instead of wasting its funds in making displays at State fairs and cattle shows.

The volume before us is but another evidence of this same policy. It is a beautiful book in every way, printing, binding, illustrations and all, and one which will be examined with interest and preserved with care by all who can obtain possession of it.

The information contained in it has been compiled with great pains and is presented in tabular and statistical form, county by county, and township by township. A colored map of every organized county in the State is given, with a careful description of its topography, quality of soil, mineral productions, number of inhabitants, school facilities, etc.

No State in the Union, so far as we know, issues so elaborate and so useful a work, and Kansas is to be congratulated on having so competent and zealous a man as Alfred Gray as Secretary of her State Board of Agriculture.

The Principles of Light and Color. By Edwin D. Babbitt, D. M., New York. Babbitt & Co., 1878; pp. 576, octavo. $4.00.

Aside from the indisputable fact that this is one of the handsomest and most elaborately illustrated specimens of book-making that has come to our table, there is a charm about Dr. Babbitt's earnest and forcible manner of treating the various branches of his subject which takes the reader with him, whether he may exactly indorse the writer's theories and reasoning or not.

The scope of the work is large, embracing: The Harmonic Laws of the Universe; Insufficiency of the Present Theories of Light and Force; The Etherio

Atomic Philosophy of Force; The Sources of Light, (Natural and Artificial); Chromo Chemistry, (the mystery of Chemical Affinity solved); Chromo Therapeutics, (marvelous cures by Light and Color); Chromo Culture of Vegetable Life, (immense growths); Chromo Philosophy, (made doubly clear by the Atomic Theory); Chromo Dynamics, or Higher Grade Lights and Forces; Chromo Mentalism, (Wonders of Color in connection with Mental Action); Vision, (Mysteries and diseases of the Eye).

The chapters on the Sources of Light and Chromo Chemistry will be found particularly interesting and valuable to all classes of readers, since they are devoted principally to descriptions and discussions of unquestioned facts in these branches of science; while the chapters on Chromo Therapeutics and Chromo Mentalism will furnish food for thought and argument to such readers as are interested in the healing power of color and in spiritualism. The theories are in many instances novel, but at the same time are claimed to be based upon and supported by actual experiment. There is no doubt that it is a most fascinating work, which will be read with the greatest satisfaction by many who have hitherto had no scientific authority to appeal to for help in their philosophic speculations. The illustrations, one of the prominent features of the work, number over two hundred and are of the finest quality.

PUBLICATIONS RECEIVED.

Report upon Magnetic Observations in Missouri in 1878, by Prof. F. E. Nipher, St. Louis. The St. Louis Journal of Commerce; the University Missourian, Columbia, Mo.; Picturesque Minnesota, a guide for tourists to the Northwest; Atti della Societa Toscana di Scienze Naturali; a Treatise on the Horse and his Diseases, B. J. Kendall, M. D., Enosburgh Falls, Vt.; The Wandering Cainidæ, or the Ancient Nomads, by Mathew Kempf, M. D., of Ferdinand, Indiana; Chicago Inter-Ocean; The Enterprise-Messenger, with an able article by Hon. B. B. Cahoon on Routes to the Sea Board; Illustrated Scientific News, New York; The Microscope in relation to Medicine and Cerebral Pathology, by I. N. DeHart, M. D., Mendota, Wis.

SCIENTIFIC MISCELLANY.

RECENT MASTODON FINDS.

On the 5th inst, Mr. Hugh Kelly, a farmer of New Windsor, New York, discovered in a swampy piece of ground near his house, the second joint of the fore leg of a Mastodon. On Sunday the excavating was continued and their labor was rewarded by finding nearly all the bones of a giant mastodon. A trench about thirty feet long, ten feet wide and four and one-half feet deep has

been dug so far and the men are yet at work endeavoring to recover what is needed to make up thé whole frame or skeleton. Operations were resumed early this morning on a larger scale and several sections of the spine, two more ribs and other pieces have been recovered to-day. A spring of cool water has been struck and the diggers are troubled bailing it out. The black vein of muck is said to be about twenty feet deep and rests on a bed of blue clay. As stated, it at one time formed the bed of a good-sized pond, and it is conjectured, as in the cases of other mastodons found, that the animal waded in beyond his depth, got fast and perished. When the upper jaw of the skull was found there was great difficulty in getting it to the surface whole. It took five men to lift it out of the trench. It was found four feet six inches below the surface. The lower jaw was four and a half feet below the surface, and some three feet distant from the upper jaw. It required two men to lift it out. The backbone and spine were not over two feet under ground. Other pieces have been found in various portions of the trench.

About the same time a Mr. Houbler, of Ottumwa, Iowa, discovered about six miles south of that place, a tusk three feet and two inches in length. The tusk, when found, was entire, and was partially covered with a deposit of scale formed by the infiltration of iron in solution acting on gravel. It was accidently broken, however, and the interior composition discloses clearly what the relic is. The tusk is four and one-half inches in diameter at the thickest part and about thirteen in circumference. The interior composition is a white substance (carbonate of lime) preserving the original structure and greatly resembling ivory. The relic is without much doubt the tusk of a mastodon, *elephas primigenius.*

On Friday afternoon, June 27th, a party went over to the celebrated "Salt-Lick," on Salt Creek, in Davis County, Iowa, where the fossil bones of a gigantic creature, supposed to be the *Plesiosaurus*, were found. This is an interesting region, abounding in petrifactions, animal and vegetable, that we propose to fully explore at some future time.—*Democrat & Times.*

THE PANAMA SHIP RAILWAY.

Captain J. D. Eads, who has so successfully completed the Mississippi River jetties, gives to the *Globe-Democrat* the following information relative to his plan of transporting ships across the Isthmus:

"Since the estimates published by the Paris Convention for the cost of the Isthmus Canal were learned by me, I have been almost incessantly studying the problem, because I felt assured that the conveyance of ships by railway across the Isthmus with perfect safety and dispatch was entirely feasible, and my recent studies have satisfied me that it can be accomplished for at least one fourth of what it will cost to cut a canal, and that the railway can be completed in one-fourth the time necessary for the canal I do not believe it possible to employ

enough men and enough machinery to execute the canal inside of twenty years, especially if it be determined to cut the canal down below the sea level. If locks be provided at each end of a canal sufficient to raise the bottom of the prism of the canal above the sea level, it will be seen at once that all danger of interruption by water rising through the interstices of the soil and rocks from the ocean itself will be avoided; but if the prism be cut down below the sea level, the sea will furnish an unfailing source of supply of water to delay the construction. This will not be a matter of serious trouble so long as the soil admits of the use of dredgers; but we have reason to apprehend that the Cordilleras will present a very different material from that which dredging machines working in water can operate upon, and if the excavation must be made below the sea level, no engineer can foretell the cost or delay to which the work will be subjected by interruptions from water. The rainy season continues from May to November, and during half of the year no work can be done in that climate."

"The methods which I suggested in my letter to the New York *Tribune* were simply those which first came into my mind, and which, although practical, admit of great improvement. Further study has led me to believe that the most economic method would be to bring the ships out of the water up an inclined plane, the ship being placed parallel with the bank up which they would be drawn—that is to say, they would be drawn up sideways, and the cradles moving on this inclined plane would have railway tracks on them, also parallel with the shore. On these tracks the cradle, or car, in which the ship is to be placed, would be run from the end of the permanent railway. When the cradles of the inclined plane were up, the tracks on them would correspond with the rails of the permanent railway, so that the ship cradle could be run on or off from them. When the ship is drawn up out of the water she would start on her journey on the railway at right angles to the direction of the inclined plane. The details or devices by which the ship can be taken out of the water admit of great variation, and it will only be by long study and careful comparison that the best and cheapest can be determined upon. Messrs. Flad and Chanute both differ from me in some of these details, and with each other, but both are engineers of unquestioned ability and great ingenuity, and I have no doubt that a few days or weeks spent with them over the problem would result in our coming to one conclusion upon every point of importance involved in it."

"The plan proposed is not new, but has been repeatedly suggested before; but I believe that no one has given it sufficient attention to work out the details, and, indeed, many of these can only be determined after careful surveys are made and the conditions presented by the location selected are fully understood. The ship-railway plan has had the endorsement of one of the ablest engineers in England. The transit of ships across the American Isthmus is one the greatest needs of the American people, and I told Gen. Grant when the jetty bill was pending in Congress that as soon as I opened the mouth of the Mississippi I intended to devote my energies to the solution of the problem. I do not wish to

interfere with or oppose M. Lesseps in the construction of his canal, but I do intend, if my life is spared, to give the necessary relief to our commerce at a much earlier date than is possible by a canal. In fact, I feel sure that the railway can be built and that its cost can be re-imbursed to its owners from its profits before a canal can be made available. I intend to ask Congress for authority to form a company to build it, and to send out an expedition to make additional surveys of the isthmus with a view to discover the best location for a railway. All the official surveys thus far made have been to select a route for a canal. The conditions for a canal are so much more difficult and exacting than for a ship-railway that I believe ten practicable locations for the latter may be found on the isthmus for every one that can be found for a canal."

SAN JUAN COAL FIELDS.

We clip the following from the New York *Mining Record*, showing that prominent journals appreciate the efforts of the TIMES to place before the public the resources of the San Juan. We know that this article has attracted the attention of several gentlemen of means who intend to give the subject a personal investigation.

"Professor Hayden, in his geological and geographical reports of his surveys of the State of Colorado, gives full testimony to the vastness of the coal resources of the San Juan region in Gunnison, Ouray and La Plata counties, in close proximity to rich veins of the precious metals, and in the line of railroads to be ultimately built. Recently and very properly, the Ouray TIMES has been calling special attention to this important demand in the future mineral development of its section of the State, in an article from which we condense the fact that from within a few miles of Mount Lincoln on the north, on the western slope, and extending around to the east bank of the Rio San Juan south, of the snowy range, the coal measures appear wherever the mountains "break off."

This coal as a general thing is a most excellent bituminous coal, as neat as anthracitc; it leaves no stain on the fingers; produces no offensive gas or odor; leavés but little ash, no clinkers, and produces no more erosive effect on stoves, grates or steam boilers than dry wood. This description will apply very nearly to all the specimens taken so far from various places in this great basin. A few miles south of Animas City, in La Plata county, are veins twenty-two feet thick and coal from these mines has been successfully manufactured into coke. No less than six strong companies have taken measures to secure coal lands from which to procure coal for coking.

The coal is in the paleozoic, lower tertiary and lower Silurian sandstone and calciferous sand rock with arenaceous clay, and in some places dark cretaceous clay with red hematite and spathic iron ores.

The enormous and unprecedented thickness of some of these coal veins, and the ease with which they can be worked, are astonishing.

Our Colorado contemporary concludes: "Here, then, is the fuel supply which will cause the San Juan mining region, in that respect, to rank second to none in the world. The coal can be conveyed at slight expense to any point by projected lines of railway, or the ore can be shipped down from the mines to reduction works in the valleys."—*Ouray Times.*

JAPANESE ÆSTHETICS.

BY REV. W. E. GRIFFIS.

In every house of the better sort in Japan there is a *tokonoma*, or raised special place for keeping objects of art and beauty. The evolution of the æsthetic out of the useful is nowhere better illustrated than in the history of the tokonoma, which was anciently the sleeping-place, or recess for the bed. Now it is a place of honor, occupying one-half of a side of the parlor or best room, its finish and appointments being superior to those of any other part of the house. It is a recess two feet deep, and raised four or six inches above the matting-covered floor. In it hang suspended on the wall a *kakemono*, or scroll painting on silk, a bronze or porcelain vase of flowers, a fan-holder with its tiers of open fans ready for use, besides other works characteristic of native art.

One of the objects often seen is a *dai*, or stand, gold-lacquered, or made of perfumed, carved, or rare wood. The dai is one or two feet high, and has on the top a black velvet or crimson crape cushion, or a silver claw, whereon reposes a globe of rock-crystal. Pure, flawless, transparent, a perfect sphere, it seems like a bubble of spring water hovering in the air. Often the dai, or stand, is a piece of elaborate art in bronze, porcelain, or lacquer, representing a beetling crag or lofty inaccessible rock, crested with the flawless jewel. Around the base the waves curl and foam, and up the side moves in crackling coil a jealous dragon. with eager, outstretched jaws, and claws ready to grasp and bear away the precious prize. Or, on a pyramid of waves hardened in bronze, with silver foam-flecks on the polish of the rolling mass, will repose inviolate the gem sphere.

The Japanese virtuoso loves to have among his collection at least one bronze of wave and stormy petrel, where, amid the recesses of the hooked foam, nestle a half dozen or more of small crystal balls, from the size of a marble to that of an apple. In nearly all Japanese art and bric-a-brac stores will be seen these gems on sale, and unless the foreign buyer's nerves are very strong, the prices asked will be very likely to startle him as though he had been touched by an electric eel.

The merest tyro in Japanese art, be he admirer or purchaser, can not have failed to notice the dragon clutching in his claw a ball or a pear-shaped jewel. In the various forms of their art expression, crystal, both in China and Japan, commands a high value, both pecuniary and symbolic. In the airy realms of imagination, and in the markets where men buy and sell, rock-crystal is among the precious things.—*Harper's Magazine for August.*

SICILY AND MOUNT ÆTNA.

It is gratifying to learn that with the restoration of peace and partial prosperity to Sicily, that noble Mediterreanean Island, more glorious in her ancient history and civilization than Rome herself, though in modern times robbed by misrule of all but the merest fragments of her once high estate, has emerged from her obscurity and begins to assume a fair portion of her pristine importance in the world. Agriculture has revived, commerce increased enormously, and science advancing equally, is about to build a new temple for herself in the very interior of the island. When the English occupied the island in 1811, during the Napoleonic wars, they built a small observatory near the base of the cone of the great crater of Mount Ætna, and the small house attached to it is still known as Casa Inglese. In the long years of trouble which followed the departure of the British troops this observatory was utterly neglected, and has partly fallen into ruins. It was too substantial, however, to be utterly destroyed, and it is now to be rebuilt upon a grander scale, and to be permanently occupied by distinguished astronomers. There are but few spots in all Europe better adapted for the work to be done. The site of the building is lofty, and the atmosphere is of unrivaled purity. It is one, too, where the marvelous beauty and grandeur of the scenery and the romance of its old historic associations will stimulate the imaginative faculties, without which no scientific explorer can hope for the most perfect and brilliant success. Mount Ætna is not nearly so generally known as Vesuvius, but this is because the latter is upon the mainland, near a great city which every one visits, and modern poetry and fiction have conspired to throw a rich halo over the famous eruption which buried Pompeii and Herculaneum under a stream of lava. For many years, too, Vesuvius has been far more active than Ætna, although, from the age of Pythagoras till 1874 history has recorded nearly eighty eruptions of the Sicilian Mountain—*Il Monte*, as the inhabitants proudly call it—and Ætna is in every respect the grander of the two. Vesuvius itself might be almost buried in the Val del Bove, a barren valley on the eastern side of the slope, surrounded on three sides by horrible precipices nearly 4,000 feet high. Ætna's legendary story is older—it goes as far back as the myths of Polyphemus and the Cyclops, it is immeasurably loftier, and Vesuvius is but a hill in comparison with the immense bulk and extent of *Il Monte*. Catania and Aci Reale, two great cities, and fifty or sixty smaller towns nestle upon its sides. And with the exception the of Val del Bove and the desert region at the base of the crater, three miles across the mouth, the whole slope of Ætna on all sides is rich and fertile, supporting a population of 300,000 souls.

Now that Sicily is nearly peaceful again, the erection of this grand new observatory will again attract the attention of the great scientific men of the age to Ætna, and through them the desire to see and explore Sicily will filter through the the great mass of travelers, ever eager for something out of the beaten track, and thus, ere long, perhaps, science may draw after her a long procession of pilgrims

from foreign lands, whose presence will be of incalculable value in promoting the full restoration of prosperity to the old granary of Imperial Rome.

The latest accounts of the eruption of Mount Ætna, now threatening with destruction several villages which have hitherto escaped the ravages of the lava, mention the formation of three distinct new craters at a great distance below the central cone, about 11,000 feet above the sea level. But these lateral escape valves, as it were, from the raging heat and fires within, are common to most volcanic regions, and from the earliest observations have been belived to be specially characteristic of Ætna. Sir Charles Lyell, who has made a close study of the great Sicilian Volcano, says that without reckoning numerous monticules of ashes thrown out at different points, there are about eighty of those secondary volcanoes or minor crators of considerable dimensions, fifty-two on the west and the north and twenty-seven on the east slope of the mountain. Monte Minardo, one of the largest, is more than 700 feet in height, and Monte Rossi, near the often-shattered village of Nicolsi, 450, with a base two miles in circumference. The new fissures which have just been pierced through the crust are, in fact, very far from a novelty in the history of *Il Monte*. They are simply another illustration of the frequent changes which have so frequently varied its surface. The great cone itself has more than once been varied, both in shape and height. After the great earthquakes of 1537 it fell in and 1693, after a temporary upheaval, it sank so much that it was invisible from many spots where it had previously been the principal feature of the landscape. The minor cones suffer similar variations in form. About 350 years ago a stream of lava so surrounded the cone called Monte Mucilli that the crest alone was left standing about the newly formed plain. Less than a century and a quarter ago another peak, Monte Nero, above the Grotta del Capre, was also almost covered by an eruption of lava and ashes from above.

The whole history of Ætna is marvelous, but one of the most extraordinary phenomena—not, perhaps, entirely dissimilar from that telegraphed on Friday—happened in 1669, nearly at the same time as the rise of Monte Rossi. In the plain of St. Lio a chasm six feet in breadth, and of depth never sounded by line or plummet, suddenly opened. Its course was winding in the ascent of the mountain, until it was suddenly closed within a mile of the summit. A brilliant light illuminated the skies from its nethermost recesses, and sounds like distant thunder were heard from time to time at a distance of forty miles. In 1832 similar, but far smaller, rents were forced open, and M. Elie de Beaumont, a distinguished French traveler and geologist, accounts for them upon the theory of an enlargement of the whole mass of the mountain by the Titanic forces of nature acting far beneath the upper surface of the earth, and finding their vent in volcanic energy. The opening of this great fissure or chasm in 1669 seems, indeed, to have marked one of the most terrible epochs of the whole history of Ætna. The ancient and beautiful City of Catania, cradled in the old days of Greece, was itself more than half destroyed. The lava overwhelmed fourteen villages, and at length reached the wall of the city built with the design of pro-

tecting its people from any possible danger from the crater. The rampart stood firm, but slowly and surely the burning stream reached its top, and then plunged over upon the devoted buildings beneath. The speed of the current was measured, and it was found that it traveled at the rate of 162 feet an hour for the first thirteen miles of its course, and in its later stages only twenty-two feet. The surface of the stream resembled a mass of solid rock, but below it was a fiery, sluggish liquid, and its resistless flow was only terminated when it reached the sea, and the molten river was then 600 yards broad and forty feet deep.

Nor are the observed and recorded wonders of Ætna confined to its surface. Volcanic action has produced subterranean grottos and underground passages which are among the marvels of nature. Lyell describes one of these great openings, the Fossa della Palomba, not far from Nicolosi. It is 625 feet in circumference at its mouth, and the upper vault is seventy-eight feet deep. Beneath this there is another huge and dark cavity, and still lower one after another in succession. Their sides are so precipitous that the descent is made by ladders, and finally at the end of a gallery, ninety feet long, there are enormous caverns, never explored and stretching, so far as science knows, into the very bowels of the earth. Of the origin of the mountain itself there are, of course, many theories. Sir Walter Raleigh, in his wonderful History of The World—yet more remarkable for its learning because it was chiefly composed in the confinement of a prison—gives a long list of authorities in support of the hypothesis that Sicily was once united to the mainland of Italy, as it has been an accepted fact England was once but a part of France. The separation, therefore, which must have taken place in prehistoric ages must have been due to the union of volcanic and oceanic action. And in Ætna even on the loftiest rocks there is much to corroborate the theory that the whole mountain was once covered by the ocean. Sea sand and marine fossil shells are found many hundred feet above the sea, and some of them are identical with species seen in the Mediterranean. In history, in tradition and in legend the Sicilian mountain thus appeals to us as no other volcano in the world can do. Of late years, in comparison with the study devoted to Vesuvius, science has been nearly mute in touching upon Ætna. For the last quarter of a century, perhaps since Gladstone's visit in 1838, she has almost disregarded Ætna. But the eyes of the whole civilized world are now fixed upon the grandest of all the volcanic mountains of the earth, and from observations now certain to be made, new lessons will be learned from the manifestation of the workings of the most tremendous forces of nature.—*Globe-Democrat.*

ART PICTURES IN STEEL.

At the meeting of the Iron and Steel Institute, says *Iron*, various art castings in steel were exhibited by Hadfield's Casting Company, Hecla Foundry, of Sheffield, where various art reproductions in steel excited great interest amongst metallurgists, it having previously been deemed impractiable to cast such articles in steel. These art reproductions illustrate some of the latest triumphs in the art of

steel casting. One of these antique pictures in steel is a *repousse* shield by Benvenuto Cellini, the famous artist in metal of the sixteenth century, and is supposed to represent the siege of Troy. Four other pictures represent the elements—earth, air, fire and water. The *basso relievos* are copies from the house of Henry the Fourth of Paris. Another represents the seasons,—spring, summer, autumn and winter. Another subject is children at play, and another is an eastern subject. These pictures are after the style of the French bronzes shown at the Paris Exhibition and were greatly admired by experienced and practical steel makers who know how difficult it is to obtain round castings in steel.

OLD TIMES.

Half a century ago a large part of the people of the United States lived in houses unpainted, unplastered and utterly devoid of adornment. A well-fed fire in the yawning chasm of a huge chimney gave partial warmth to a single room, and it was a common remark that the inmates were roasting one side while freezing the other. In contrast, a majority of the people of the older States now live in houses that are clap-boarded, painted, blinded and comfortably warmed. Then the household furniture consisted of a few plain chairs, a plain table, a bedstead made by the village carpenter. Carpets there were none. To-day few are the homes in city or country that do not contain a carpet of some sort, while the average laborer by a week's work may earn enough to enable him to repose at night upon a spring bed.

Fifty years ago the kitchen "dressers" were set forth with a shining row of pewter plates. The farmer ate with a buck-handled knife and an iron or pewter spoon, but the advancing civilization has sent the plates and spoons to the melting pot, while the knives and forks have given place to nickel or silver plated cutlery.

In those days the utensils for cooking were a dinner-pot, tea-kettle, skillet,. Dutch oven and frying-pan; to-day there is no end of kitchen furniture.

The people of 1830 sat in the evening in the glowing light of a pitch-knot fire, or read in their weekly newspaper by the flickering light of a "tallow-dip;" now, in city and village, their apartments are bright with the flame of the gas-jet or the softer radiance of kerosene. Then, if the fire went out upon the hearth, it was rekindled by a coal from a neighboring hearth, or by flint, steel and tinder. Those who indulged in pipes and cigars could light them only by some hearthstone. To-day we light fire and pipes by the dormant fire-works in the match-safe at a cost of one-hundredth of a cent.

In those days we guessed the hour of noon, or ascertained it by the creeping of the sunlight up to the "noon-mark" drawn upon the floor. Only the well-to-do could afford a clock. To-day who does not carry a watch? And as for clocks, you may purchase them at wholesale, by the cart-load, at sixty-two cents a piece.

Fifty years ago how many dwellings were adorned with pictures? How

many are there now that do not display a print, engraving, chromo, or lithograph? How many pianos or parlor organs were there then? Reed organs were not invented till 1840, and now they are in every village.

Some who may read this article will remember that in 1830 the Bible, the almanac, and the few text-books used in school were almost the only volumes of the household. The dictionary was a volume four inches square and an inch and a half in thickness. In some of the country villages a few public-spirited men had gathered libraries containing 300 to 500 volumes. In contrast, the public libraries of the present, containing more than 10,000 volumes, have an aggregate of 20,650,000 volumes, not including the Sunday-school and private libraries of the country. It is estimated that altogether the number of volumes accessible to the public is not less than 20,000,000! Of Webster's and Worcester's dictionaries, it may be said that enough have been published to supply one to every 100 inhabitants of the United States.—*C. C. Coffin, in May Atlantic.*

CLASSICAL ORIGIN OF BOSTON BAKED BEANS.

It is known to most of the inhabitants of the Ball that makes its diurnal revolutions around the Hub that we, who enjoy the felicity of dwelling in the center of all things, celebrate the rise of the Sunday sun by a repast of pulse and brawn, sometimes spoken of as "pork and beans," or "bacon and beans." Like most of the facts in the experience of the Bostonese, this habit has been pretty well advertised, and sometimes there have not wanted those of the vulgar herd who have been moved to animadvert with asperity upon the well-established custom We look upon all such flings with the lofty disdain that arises from a mind conscious of its own rectitude, and with pity for the ignorance from which they spring.

Generations ago, when many other parts of our noble land were howling wildernesses, our ancestors overhauled their classics, and made a note of the fact that the poet Ovid, of blessed memory, in his remarks appropriate to the calends of June, gives an account of the rite to which I have referred, which was promptly incorporated into the calendar of our beloved city.

We are classical, or nothing. We know that it is the good goddess Carna who protects the lungs and liver of man (or at least that she was wont to do so in classical times), and that in her honor the good people of classical days ate repasts of pulse and brawn. "You ask," says Ovid, "why fat bacon is tasted on these calends, and beans are mixed with the boiled spelt. She is a goddess of ancient days, and she still diets on the food that in olden time she used, and she does not, in a spirit of luxury, ask for the dainties of foreign lands. In that day the fishes swam uncaught by a people ignorant of the virtues of the succulent cod and of the luxury of fish-balls; and the oysters were still safe in their shells, no man having yet been found with sufficient courage to swallow even one of them.

Latium had not become acquainted with the woodcock which rich Ionia supplies, nor with the cranes that delight in the blood of the Pygmies. The toothsome peacock pleased but by its expanded tail, nor had foreign lands been drawn upon for their beasts of the chase. But swine were valuable, and by killing a sow the fathers honored their festivals. The rock-bound land produced only beans and the hard-grained spelt, and whoever eats these two things mingled, they say that his stomach can receive no harm."—*Contributors' Club*, *May Atlantic*.

ABSENCE OF AGUE IN KANSAS ACCOUNTED FOR.

"But you have ague in Kansas, the same as in every other new country, don't you?" inquired Mr. Wabash.

"Only as it is brought in temporarily, from other States," Markley politely responded. "It is not indigenous. We have no malaria. Our atmosphere is rich in ozone; and ozone is nature's own purifier. Homer mentions it in the Odyssey, you recollect, where he speaks of the atmosphere being 'quite full of sulphurous odor.' That's ozone.

"I presume the atmosphere of the infernal regions is also quite full of sulphurous odor,'—or ozone," said Mr. Wabash with a chuckle.

"Yes, I suppose so," Markley retorted, promptly; "put there, no doubt, to tantalize the fellows with suggestions of Kansas. 'Sorrow's crown of sorrow,' you know, 'is remembering happier things.' But as I was about to say, ozone dispels malaria, and keeps the climate free from bilious conditions. Besides, the ague is really a matter of morals rather than of physics, you understand." But we did not so understand it, and he therefore graciously proceeded to enlarge upon the statement for our benefit. "The ague always hovers about low, flat lands, where the soil is thin and jaundiced-looking, and where the inhabitants go on voting for Gen. Jackson for president. Take those quinine river bottoms in some of the Western States—I shan't call names—where the men gather at the saw-mill every Sunday to pitch horseshoes and shoot at a mark; there's where you'll find ague every time. Then move out on the high, open lands, where they have Sabbath schools and debating societies and collars to their shirts, and you'll see very little of it, usually none at all; the sickness there, when they have any, runs in the nervous way." Mr. Wabash laughed good-humoredly, and ventured some light remark about finding out more the longer we live; but Markley kept on in a solemn and impressive manner, as if charged with a special mission on the ague question: "It's considerably due to our school system, our free press, and our numerous churches, I tell you—added to the abundant ozone—that we are so little bothered with the thing in Kansas. We have four million dollars' worth of school-houses, and nearly two hundred newspapers, and churches till you can't rest. There's no foot-hold for ague among such things—and a sky full of ozone hanging over them. It's very much a matter of civilization, this

ague business. It's the difference between the sallow squirrel hunter, with his rifle on his shoulder and a gaunt hound at his heels, and the clear-complexioned, grammar-respecting man of the new era, with books and papers on the table and a canary bird swinging in the window. They had no ague in Athens, you may be sure; they have none in Boston—to speak of."—*Capt. Henry King, in Atlantic for August.*

THE ZOOTROPE.

When Mr. Edward Muybridge, of San Francisco, assisted by Gov. Stanford, made, in the spring of 1878, his first photographs of the horse in motion, it became evident to those who had been previously engaged in studying the subject of the locomotion of animals that they had never before had any such material for their investigations as that which he then presented. His process, briefly, consists in having a number of photographic cameras on a proper support near the level of the ground, at equal distances—say twenty-seven inches apart. Opposite to the cameras, and parallel to the line in which they stand, is a white screen or fence, the vertical lines, also twenty-seven inches apart, drawn on its surface, one directly opposite to each camera. A wire, with proper electrical connections, leads from each line to the corresponding camera. The animal whose motion is to be photographed is driven or ridden on a line parallel with the screen in front of the cameras, and as he crosses each wire the slide of the camera corresponding to that wlre is opened, and a photograph of the animal in that position is obtained. In the experiments on a horse at racing speed, for example, the animal covers about twenty-two feet in each stride; ten cameras, therefore, twenty-seven inches apart, would record ten different portions of one stride or step The photographs thus produced show the successive positions, the transitions from one to the other of which are altogether too rapid to be appreciated by the eye

—*Art Interchange.*

EDITORIAL NOTES.

In view of the fact that several articles have appeared in the Review which have provoked criticism, it may be proper to state that while the editor holds its columns open to free discussion of current topics of popular interest, he does not thereby necessarily indorse nor hold himself responsible for the statements or theories of its contributors.

Erratum—The specific gravity of the water of the sink hole in Meade Co., Kansas, described by Prof. Mudge last month, should have been given as 1.11 instead of 10.719.

Rev. William G. Schauffler, father of Prof. E. W. Shauffler of this city, the latter an accomplished scholar and master of several modern languages, has received from Princeton Colllege the additional title of LL.D. The New Jersey *Evangelist* makes a lengthy reference to the circumstance from which we quote a few lines: "Among the honors bestowed at the commencement of the present year, not one has fallen on a head more worthy to receive it than LL.D. placed by Princeton on the "good gray head" of the venerable missionary, William G. Schauffler, D. D., late of Constantinople."

WE learn from a letter to the American Library Bureau of New York, that Prof. R. A. Proctor, who was so enthusiastically received here in 1877, will return to the United States in October and remain until the following spring, lecturing in various portions of the East and West on his favorite subject, Astronomy. Among other topics he proposes to reveal some curious discoveries he has made in regard to the Great Pyramid. This subject having been pretty well discussed in the REVIEW by our well known contributor, Rev. James French, with the result of greatly interesting many of our readers, it would be particularly appropriate to invite Prof. Proctor to deliver that lecture, among others, here, and doubtless the Academy of Science will promptly open correspondence with him.

PROF. B. F. MUDGE of Kansas, commences in the REVIEW a series of articles combating in several points the views of the evolutionists derived from their geological researches and studies. As Professor Mudge has had as large an experience in the study of fossils as any man is this country, both in field and cabinet, his views will be regarded with respect by all classes of thinkers, and will doubtless call forth from all sides a pretty sharp controversy, in which we are confident that he will be able to maintain himself well.

COL. VANHORN calls attention to the fact that "the tornadoes are traveling a little farther north, and the higher latitudes are experiencing in July what we did in June. If meteorologists would note the fact that these tornadoes travel north with the season, they might find a clue to their origin and causes that is not known at present. In Texas, Louisiana, Arkansas and other extreme southern points they occur in March and April; in Kansas and Missouri, about the last of May and the first of June, and in Minnesota and that latitude, in July. This rule has its exceptions, we know, but the uniformity is such that a general cause must underlie them."

JOHN P. FINLEY of the U. S. Signal service, Washington, D. C. who has spent several days tracing out the lines of the June tornadoes in Kansas and Missouri, gave us a brief call on the 15th inst. His report will be looked for with great interest by the advocates of the various storm theories.

WE were much gratified a few days since by an unexpected call from the well known geologist, Tylor McWhirter, Esq., of Aledo, Ill.

PROF. C. E. ROBINS, writes from Summit, Colorado July 2, that "the 'Little Annie' mine is moving regularly along on her fifth annual campaign, and making a fair yield of amalgam with her ten light stamps. An important strike of $150 gold ore in place and in quantity has been made in the Missionary mine, at the base of South Mountain in this mining district. The 'find' has given unusual animation to the camp."

WE are indebted to Prof. Wm. J. Marshall of Fitchburg, Mass., for a series of photographic illustrations of the natural Yellowstone Park scenery and wonders, being *fac similes* of the beautiful views shown our citizens on the occasion of his lecture under the auspices of the Academy of Science last spring.

MAJOR DAVID J. MILLER, translator and chief clerk, in the United States Surveyor General's office, Santa Fe, New Mexico, writes: "I here inclose a $2.50 postal money order, wherewith to renew my subscriptional term to the REVIEW. I trust you are realizing in large degree the success which your excellent periodical deserves, and that your pecuniary success will keep pace with the celebrity your journal is attaining in the world of scientific learning and progress."

THE telephone has been put to a novel use in Italy. Professor de Rossel, of Rome, has used the instrument in detecting and measuring subterranean sounds at Vesuvius, and reports his experiments as highly successful. The telephone, before being adjusted, when artificial vibrations had no effect upon it, repeated violently the shocks and rumblings at

the bottom of the crater of the volcano, and, as the Professor expresses it, "registered shocks of earthquake otherwise imperceptible."

THIS is the way lady scientists in the United States dress and are appreciated at the President's levees in Washington. "A tall lady whose blonde curls were just shading into gray, her neck covered with diamonds, and a superb white satin dress trailing after her, was one of the most striking persons in the rooms. Great attentions were shown her, and admiration was heightened into something more when she was introduced as Mrs. Martha J. Coston, the inventor of the night signal system now in use by the Government."

WE call attention to the announcement of the Kansas State University in our advertising pages. This institution is well provided with every facility for teaching, including an able and experienced faculty, while the building itself cannot be excelled in the West in its adaptiveness to the purposes of its construction. Lawrence presents all of the attractions of a university town that so comparatively young a town can, in the culture of its people, and the quiet and charming beauty of the city itself; and the institution is rapidly gaining a national reputation.

EDISON'S Electric-Chemical Telephone dispenses with the necessity of holding the telephonic receiver to the ear, and besides furnishing a greater volume of sound, renders distinct the slightest peculiarities of the voice. It has been found to work perfectly at a distance of fifty miles. The improvement consists in causing the current to pass through a spool of chalk containing crystallized caustic soda, and having a thin tongue of steel resting upon it. The chalk is mounted on a shaft turned by a crank, thus causing friction; and when so operated, the current passing through the spool polarizes the chemical agent, and is thence transmitted through the steel tongue to a thin metallic diaphragm. The current only flows so long as the crank is turned. It is Mr. Edison's intention to furnish clock-work for the mechanical movement, so that it may be stopped and started by electricity at the will of the speaker.

The hottest day of the season in this city, so far, was Tuesday, July 22d, when our thermometer registered 80° at 7 a. m., 95° at 2 p. m. and 87° at 10 p. m. The heat in some parts of the city on that day, is said to have reached a maximum of 104° in the shade, at about 3 p. m.

THE British Museum is about to acquire a well-preserved Egyptian papyrus, belonging to the time of the later Ptolemies. It contains nearly the whole of the thirty-fourth book of the Iliad. The Museum has secured another papyrus, even more ancient, recently found in an Egyptian tomb, and containing an almost complete transcript of the eighteenth book of the Iliad.

THE KANSAS CITY REVIEW OF SCIENCE AND INDUSTRY, Theo. S. Case, editor, comes to us filled as usual with valuable facts, well discussed theories, and useful suggestions. It speaks well for the intellectual growth of the country where such magazines flourish amid the hurry of the busy workers of the prairies of the west.—*The Inter-Ocean, Daily.*

AMONG the prominent features of the Missouri University (an announcement of which appears in our columns, this month) is the engineering department, which is in charge of Prof. T. J. Lowry, C. E. The courses are: I. CIVIL ENGINEERING. II. TOPOGRAPHICAL ENGINEERING. III. MILITARY ENGINEERING. IV. SURVEYING. Each leading to its appropriate degree (and diploma.) The course in Civil Engineering is designed for those who wish to make either road and railroad engineering, bridge construction, or river improvement, a specialty. The course in Topographical Engineering is arranged for those who find distasteful the higher analytical Mathematics, and who show instead special aptitude for the surveys and improvements of rivers, lakes and coasts. The course in Surveying fits young men for navigation, practical astronomy and the U. S. Government trigo-

nometrical, geological, magnetic, coast and river surveys, all of which are now under way. All departments of the University are in excellent hands and its greatly improved facilities for educating its students are being recognized throughout the state and the country. We referred but a few months since with pride to the splendid opportunities offered by this institution, as shown by its catalogue. Since then we have visited it and can now speak from personal knowledge. Every citizen of this state may send his children there with absolute confidence that they will receive the best of instruction.

THE Great Publishing House of George Stinson & Co., of Portland, Maine, moves steadily on in the even tenor of its way, apparently not feeling the dull times. During the year 1878 they sold over four million pictures of all descriptions. They publish every description of fine pictures, and the prices range from ten cents upward to twenty dollars per copy. We have personally examined several of their later engravings and do not hesitate to declare them exquisite in design and execution.

SMITHSONIAN INSTITUTION,
WASHINGTON D. C. June 18, 1879.

EXTRACT.

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Your REVIEW comes regularly and is always read with much interest.

Yours truly,

S. F. BAIRD, Sec'y.

A PRIZE of £100 for an essay on hydrophobia, its nature, prevention and treatment, having been offered by Mr. Stanford, M. P., to be awarded by the royal college of physicians of London, the Marquis of Salisbury has instructed the British minister at Washington to bring the matter to the attention of the Department of State, that the necessary publicity may be given to the same in the United States. The conditions under which the above prize is to be competed for are, that the essay must be in English, or accompanied by an English translation, and be delivered to the college on or before January 1, 1880. The essay must be accompanied by a sealed envelope, containing the name and address of the author, and bear- a motto on the outside, the same motto to be inscribed on the essay, and may be the joint production of two or more authors.

CURRENT LITERATURE.

The most interesting article in the *American Naturalist* for July, is that by Prof. C. E. Stearns, on the Form of Seeds as a Factor in Natural Selection in plants.

The *North American Review* for August, 1879, presents the following attractive table of contents: The Work and Mission of my Life, Part 1, by Richard Wagner; The Diary of a Public Man; Garrison, by Wendell Phillips; The Power of Dissolution, by Edward A Freeman; The Founder of the Khedivate, by the late John L. Stevens; The Future of Resumption, by an old Financier; Recent Works on Ancient History and Philology, by John Fiske.

A WRITER in the Washington *Republic* says: "If personal appearance counts for anything, I am inclined to the opinion that the Administration has been fortunate in the selection of Mr. Clarence King to be at the head of the great bureau of surveys which the last Congress established. A keen, bright face, set as an index to a large well-developed head —a face frank in expression—pleasant, kind, firm; a short compact figure, with energy outlined in every movement—a rather rare combination among our public officers. I shall be disappointed if Mr. King does not make both a very popular and a very efficient director."

WE are indebted to Mr. S. B. Davis of the Ottawa, Iowa, *Democrat and Times* for an interesting account of an exploration of several ancient mounds near Eldon on the DesMoines river. Nothing of special interest was found within the mounds, but near the McClure group several relics were picked up: among them a stone axe weighing 3 pounds, several arrow heads and a "turtle back."

Professor Patrick, of the State University of Kansas, takes the position, in an article in the *Scientific American Supplement*, that alum baking powders may be used without injury to health, and sustains the position by a series of experiments with such powders upon cats.

The Jeannette sailed from San Francisco on the afternoon of July 8th. She is a bark rigged steamer of 420 tons register, 200 horse power, and apparently admirably calculated to successfully perform her mission. The *Boston Journal of Commerce*, however, thinks that the selection of a staunch sealing vessel would have been much better.

The *Boston Journal of Chemistry* is publishing an admirable series of articles on house building, in which beauty, strength, economy, convenience and hygiene are equally considered.

The *La Plata Miner* says: "This rich mineral mountain, Sultan Mountain, just south of Silverton, is making a splendid showing. At least six mines are already shipping paying ore in quantities that guarantee profits in their working. The mines that are at present being worked at a profit, are the Cleveland, Molos, King, Belcher and North Star, the last named having 200 tons of 100 ounce ore on the dump."

The *Mirror of Progress* is a new weekly edited and published by our well-known fellow-citizens Judge E. P. West and D. Eccles. It is presented as an exponent of western liberal thought. We bespeak for it a liberal patronage.

Experimenters in electric lighting will find a useful article in the *American Journal of Science and Art*, for July, upon a method of preventing the too rapid combustion of carbons in the electric lamp, by H. W. Wiley.

The *Sanitarian* for July contains an exhaustive article by Prof. Doremus, the distinguished New York chemist, upon Epidemics from a Chemical stand point, which contains important suggestions relative to the employment of "chemical agents for thoroughly disinfecting clothing, ships, and even our houses and hospitals of solid masonry.

The *American Antiquarian* for April, May and June, 1879, has made its appearance and is full of most interesting articles. It is now published by Jameson & Morse, Chicago.

Among the excellent articles in the *Popular Science Monthly* for July, is one by Prof. Wm. H. Wahl, of Philadelphia, upon Wasted Forces, in which the author shows, in a striking manner the boundless dynamic resources of nature, and proves conclusively that even should the coal supply suddenly fail, the manufacturer need have no apprehension of his engines stopping for want of motive power.

According to Prof. F. E. Nipher, of Washington University, St. Louis, Mo., in his report on *Magnetic Observations in Missouri*, 1878, the exact geographical position of Kansas City is Latitude, 39° 07.2′, and Longitude, 94° 37.7′.

PUBLICATIONS RECEIVED.

Other publications received: *Smithsonian Institute Reports*, 1876 and 1877.—*Proceedings of the Academy of Natural Sciences of Philadelphia*, Part I., January, February and March, 1879.—*Atti Della Societa Toscana di Scienza Naturali*, Mar. 9, 1879.—Louisville *Monthly Magazine*, February, 1879.—"The Microscope in its Relation to Medicine and Cerebral Pathology," by J. N. De Hart, M. D.—"First Catalogue of Radiant Points of Meteors," by Edwin F. Sawyer.—*The Pharmacist and Chemist*, Chicago, March, 1879.—*The Meteorologist*, Vol. 1, No. 4, monthly, Greensburg, Pa., 50c per annum.—*The Inter-State Normal Monthly*, Moulton, Iowa, 75c per annum.—*Our Mirror*, High School, St. Louis, $1 per annum.—*The House-Furnishing Guide*, New York, monthly, $2.—*Inventors' and Manufacturers' Gazette*, Boston, monthly, 50c.

KANSAS CITY

REVIEW OF SCIENCE AND INDUSTRY,

A MONTHLY RECORD OF PROGRESS IN

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VOL. III. SEPTEMBER, 1879. NO. 5.

GEOLOGY AND PALÆONTOLOGY.

BOTANY AND EVOLUTION.

BY PROF. B. F. MUDGE, MANHATTAN, KANSAS.

I. PLANTS—FOSSIL VEGETATION.

A great American botanist has stated that evolution is a problem the solution of which is reserved to vegetable palæontology. Let us, then, see what light can be thrown on this great question by a study of fossil plants.

The botanist, looking at the changes of plants living under his observation, can be excused in concluding that one form has been derived from another. He finds a marked variation in a single generation, and he hastily concludes that a hundred generations will give a hundred times as much variance. But a more careful observation will teach him that the divergence from a normal standard is confined within a limited and fixed circle. Beyond that circle, a hundred generations will not change it.

It is true that our first and oldest type of vegetation in the oldest strata of the Silurian Age, is of a low order. It is represented by marine families (Thallogens), which to-day, all over the ocean, are of simple organization. The close resemblance between the earliest forms and those now found in the ocean is very apparent. Thus the genus *Chondrus crispus*, or Irish moss, is represented in the lowest Silurian by three species. *Palæchorda*, or Dead-man's-rope, now living, is also found in the same beds with nearly generic structure. In short, the whole aspect of the Thallogens of the oldest fossiliferous rocks is so like the present that if we

accept the one as the lineal descendant of the other, we should have no change of type, no new organs, nor, in fact, any development of a single new trait in these low plants in fifty millions of years.*

As in the Lower Silurian Age there was little, if any, dry land, we could not expect other forms. Scarcely any dry land existed till the Devonian Age, and then only in a limited extent. Even in that era we have few land plants.

At the close of the Upper Silurian we find the first land plants—Lycopodons, or Ground-pines. If not generically the same as those now living, they are very closely allied. These are not the lowest land vegetation, but are Acrogens, the highest of the flowerless plants. Mosses, lichens, and other lower orders, had not yet appeared, and are not known till near the close of all geological history.

But what is more striking in illustrating the progression of vegetation, is the appearance, about the same time, of one of the most common families of our present forest—viz., the Conifers, or Pines. Nor is there the slightest evidence that these Pines had any connection with, or derivation from, any lower type. Both Lycopodons and Conifers have also retained their distinctive characteristics from that time to the present without changing to any higher order, or merging into any advanced vegetation. The *Araucaria*, now living, is recognized by all botanists to be of the same genus with the pines of the earliest Devonian. In plant rank it stands as high as the Norfolk Island Pine or the Cedar of Lebanon.

The Pines, it must be recollected, were the first *trees*, and, though it is sometimes difficult to say that one order is higher than another in organization, yet no botanist will assert that the Pines are low. While our shade and fruit trees (Oaks, Apple, etc.), are placed higher, the Cycads and Palms are, without question, much lower than Conifers. Yet the Cycads first appeared in the Carboniferous Age, and the Palms in the Cretaceous. If vegetation developed from a lower to a higher type, the Palms should have existed long before the Cycads, and both far in advance of the Pines. The latter, instead of being in the Devonian, should have lived after a later interval than the former; or, rather, one should have been seen to merge into a higher type and disappear in it, ceasing to be found in its first form, and only represented by a more noble organization. The Palm should have ceased in the Cycad, and the latter in the Pine, dropping all old forms and habits, just as the offspring throws off the embryonic and assumes the features of maturity.

Is it not antagonistic to the doctrine of evolution, that we have Lycopodons Cycads and Palms, to say nothing of more simple forms, living side by side with our more complex and highly organized vegetation? This anomaly exists in almost all divisions of natural history. No family is now without its low organism living with the higher; and very frequently the lowest of the present are far inferior to any of their classes found fossilized. If evolution requires for a beginning only low families, genera and species, the latest and most recent period should possess only the highest.

* Prof. J. D. Dana says the oldest fossils of the Silurian are not less than fifty millions of years old. I shall use these data in the relative ages of plants in different deposits, in this article.

The geological history of the Pine is very instructive in the study of evolution. From its first appearance, in the fossil state, to the Age of Man, it has retained all its characteristic features without any material variation or advancement, for it is difficult to see how much, if any, superiority exists in the more common Pines over the *Araucaria*, or type of the Devonian and Carboniferous ages. The forms of the fruit (cones) and leaves have not made any important changes during half the period of the earth's geological history. From the Upper Silurian to the present era, a period of not less than twenty-five millions of years, the normal style of trunk, with its annual rings, leaves and cones, has remained the same. Not only this, but even the microscopic structure of the wood has remained persistent. It has not, and never had, the ducts common to the Dicotyledonous trees, now represented by all other forest trees of the temperate zones. Even the form of the cell, with its minute makings, so small that a high magnifier is required to see them, has remained the same. The elongated form of the cell, with its dots, or thin spots in the walls, is still preserved during these long geological periods. When we consider that the cell is only one three-hundredth of an inch in diameter, and the wall is only a fraction of this diameter, and the thin spot is only half the thickness of the wall, is it not most remarkable that this most minute structure should always have remained?

We give figure 9, showing a portion of a cell of *Pinus strobus*, or common white pine, with dots, magnified three hundred times. Figure 10 shows portions of four cells, on the same scale, of Australian Pine, *Araucaria Cunninghami.* The latter agrees with the old Devonian fossils. The diagrams show that the only difference in these extreme genera is that the dots in one are placed opposite each other, while in the other they are alternate. It will thus be seen that there is little, if any, variation, even in the most minute portions of the tree. If that portion of the cell, not more than one ten-thousandth of an inch in thickness, has not changed its structure in one-half of the earth's geological history, does it not show that the ruling law in the vegetable world is persistence, and not change—a fixed normal standard, and not a progressive, changeable element?

During all the existence of the Pines, since the Silurian, in every later geological formation, and in almost every portion of the globe, under all the varying conditions of our planet through these twenty-five millions of years, we discover no divergence of the characteristic form of the tree, or its products, toward any other family of plant life. We find none running to it and none diverging from it. Many other lower forms have succeeded, instead of preceding it.

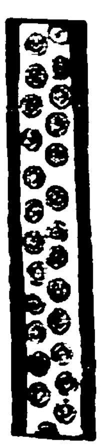


Fig. 9.

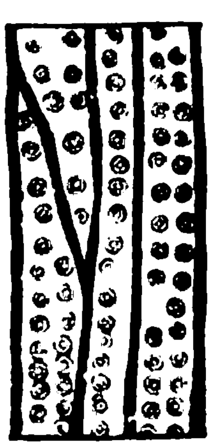


Fig. 10.

The *Araucaria* of Australia and Patagonia, though called in the books by different specific names, may be the lineal descendants of the oldest Silurian. Were it not the habit of

Fig. 9, fibres of ordinary coniferous wood (Pinus Strobus), longitudinal section, showing dots, magnified 300 times; fig. 10, same of the Australian Conifer, Araucaria Cunninghami. After Dana. Manual p. 184.

palæontologists to give a new name to a familiar fossil when found unexpectedly in another geological formation, they would probably have been recognized as the same species.

All our distinguished fossil botanists have recognized the persistent characters of the Conifers. Frequently they express this opinion pointedly in reference to particular species. Saporta and Marion, in their "Flora of Gelinden," speaking of *Pinus Quenstedti*, which is found in Kansas in the lowest Cretaceous, and in Greenland in the highest, say: "This species does not differ in character from the living Mexican species with quinate leaves." So *Sequoia fastigiata*, in the deposits of Kansas, Moletin and Greenland, is considered by Lesquereux very nearly the same as the living *S. gigantea*, or the "Big Trees," of California. Prof. Gray expresses his idea of the close resemblance in the following terms: The twigs of the *Sequoia* in the Eocene are "so very like *S. gigantea* of the Sierra Nevada that, if such fossil twigs, with leaves and cones, had been dug up in California, instead of Europe, it would confidently be affirmed that we had resurrected the veritable ancestors of our giant trees." Thus closely do the fossil *Sequoia* of the Cretaceous and Tertiary deposits of Kansas, Greenland and Europe agree with the living trees of California. The Bald Cypress, now our only living species, has a close ally in the Cretaceous *Glyptrostrobus*, "a sort of modified *Taxodium*, about as much alike as one species of Redwood is to another."

It must not be forgotten that the Pine grows in most varied climates, and in most diverse positions. It is found near the snow-line in Colorado, 11,000 above the sea, and on the level of the ocean in the same latitude; on the damp shores of Maine and the dry plains of the West; on stony hills and in fertile valleys. Note the great change of circumstances under which the Auraucarian Pine has existed without varying from its original structure. Since its birth on the small and scattered islands of the old Silurian ocean, every foot of land has been repeatedly submerged. The Pine has been obliged to migrate from place to place to retain a footing above the sea. All our continents have been formed and reformed. Our mountain ranges, in every quarter of the globe, are young compared with this genus of trees. The wet, tepid climate of the Carboniferous, and the semi-tropical of the Mesozoic ages, were succeeded by the Glacial Period, which covered half of the Temperate Zone with a sheet of ice a mile thick, and yet, amid all these vast mutations, the *Araucaria* has remained unchanged. Could any more diversified circumstances be imagined to affect the growth of a plant? Can any more definite evidence be given that changing circumstances cannot carry organic life beyond its narrow circle of vitality? Surely, if physical variation of the earth's surface, and vacillation of climate, could change a plant, the Pine might, during so many millions of years, have shown almost any change.

After the introduction of the Pine, the next important grade of plant life is represented by the Cycads. They are a comprehensive type, combining some characteristics of Ferns, Palm and Pines. They approach the last more nearly than either of the others, particularly in flowers and fruit. They differ from the

Pine in several respects, but mainly in secreting starch in a large pith, instead of rosin in the outer or sap layers, and in having ring layers which are not of annual growth. They grow only in the Tropics, while the Pines extend to Temperate and sub-Arctic regions. All these peculiarities the Cycads retain from their first appearance to the present time. The comprehensive, or "prophetic," features, therefore, fail of any result. They are still seen in the living Cycads. There is no preceding form from which they were derived, and, while they held their permanent form, they had no collateral branch connecting them with the Pines or any other allied type.

As a comprehensive type, the Cycads appear in the wrong relative position. If they were "prophetic," they should have preceded the Ferns, Palms and Pines, whose features they embrace. These comprehensive forms have accompanied other families, both in the animal and vegetable kingdoms, and have either succeeded or run parallel with the more specialized forms, into which they are said to have been developed. All the more important comprehensive orders are living at the present age, when they should have long ago disappeared in the higher structures which they foreshadowed. If they were the ancestry of those having more special forms, they should have appeared first, and, becoming merged in the more perfect types, should have disappeared in the metamorphosed structure.

The extremes of the earth's physical features attending the existence of the Cycads, have been nearly as great as we have noted in relation to the Pines; yet all these vicissitudes of circumstances have not changed their generic traits.

Although the Palms are far inferior in structure to the Cycads, they did not appear till long afterward, viz.: at opening of the Cretaceous Age. So that, instead of appearing earlier than the Cycads, as they should to be in harmony with the theory of development, they are less than half as old. It is also singular that the Palms should have first been found with the first of the far higher grade of Dicotyledons, the two extremes of trees thus appearing simultaneously. Can this incongruity be explained by any principle of evolution?

The persistent characteristics .which we have noticed as pertaining to the Pines and Cycads, are true of the Palms. When they first came into existence they had all the marked features of structure which they retain to-day. No derivation from or divergence into any other type has been discovered, though carefully sought. The genus Sabal is the earliest known, and yet it now lives in the Tropics, no more perfect and no less perfect than in the early Cretaceous Age. It always comes from the ground with one cotyledon, and never had the power to add another. Its tuft of parallel veined leaves has never shown any ability to reticulate. Its internal fibrous texture has never become consolidated into annual layers. In short, it is still not only a Palm, but a Sabal.

When the Palm first appeared it had a wide geographical range. Its remains are found on both continents, and it always entered on the stage of plant life with the higher Dicotyledons. It grew in Europe when that grand

division of the globe was represented by a few islands. It flourished on an archipelago where now is the center of North America, before the Rocky Mountains had begun to rise out of the ocean. Here have been changes sufficient to have modified the tree had it been susceptible of evolution, and to have developed it into a different plant life. But when conditions were opposed to Palm life, it did not change, but migrated (by floating seeds), or became locally extinct. Like all other vegetation, as geology reveals it, the Palm shows a strong stability in maintaining its normal form. No fossil exists from which it was derived, and, in its long history, extending through one-eighth of the earth's organic period, it has left no traces of divergence to a higher plant life.

Figure 11.

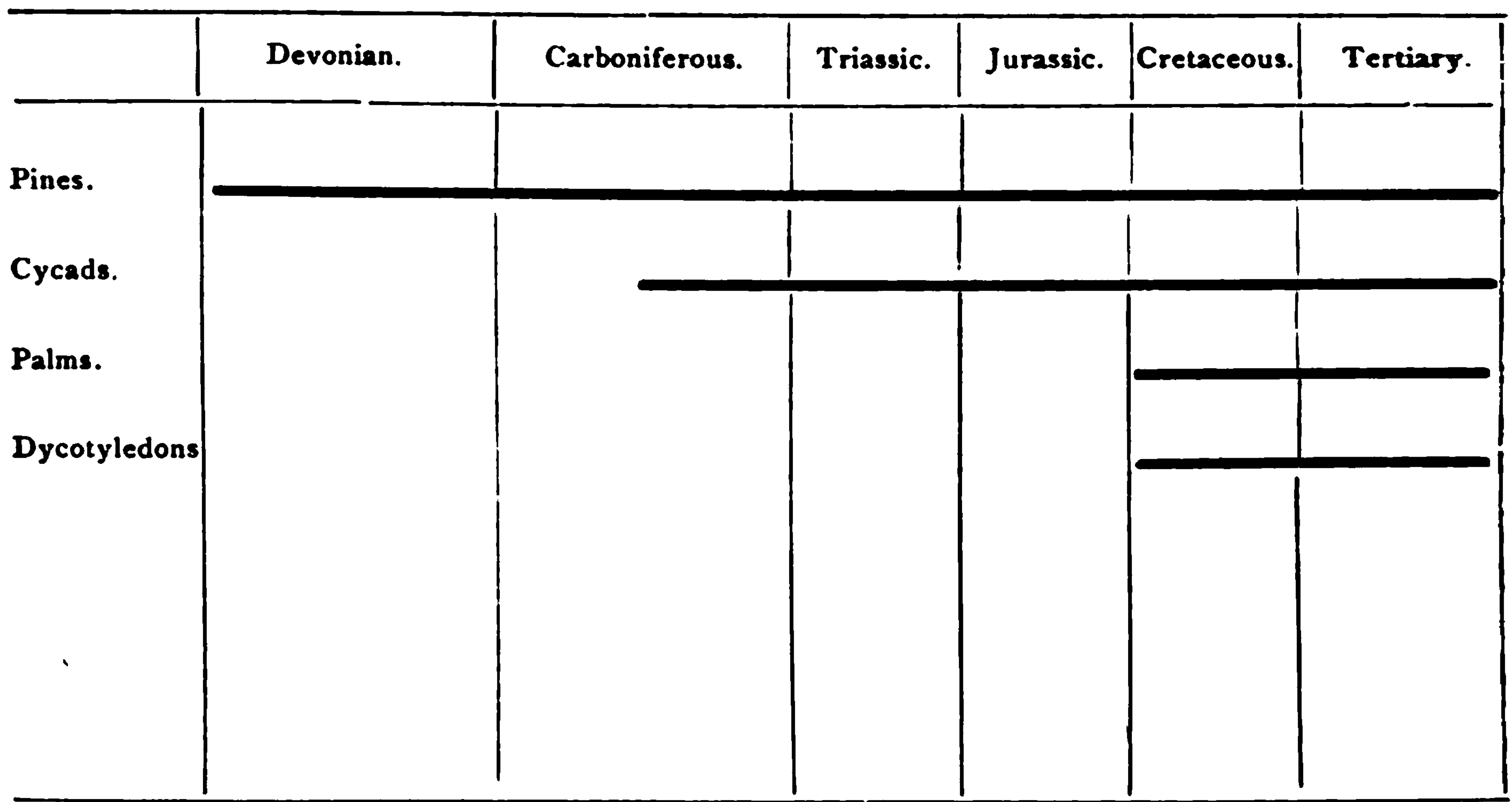
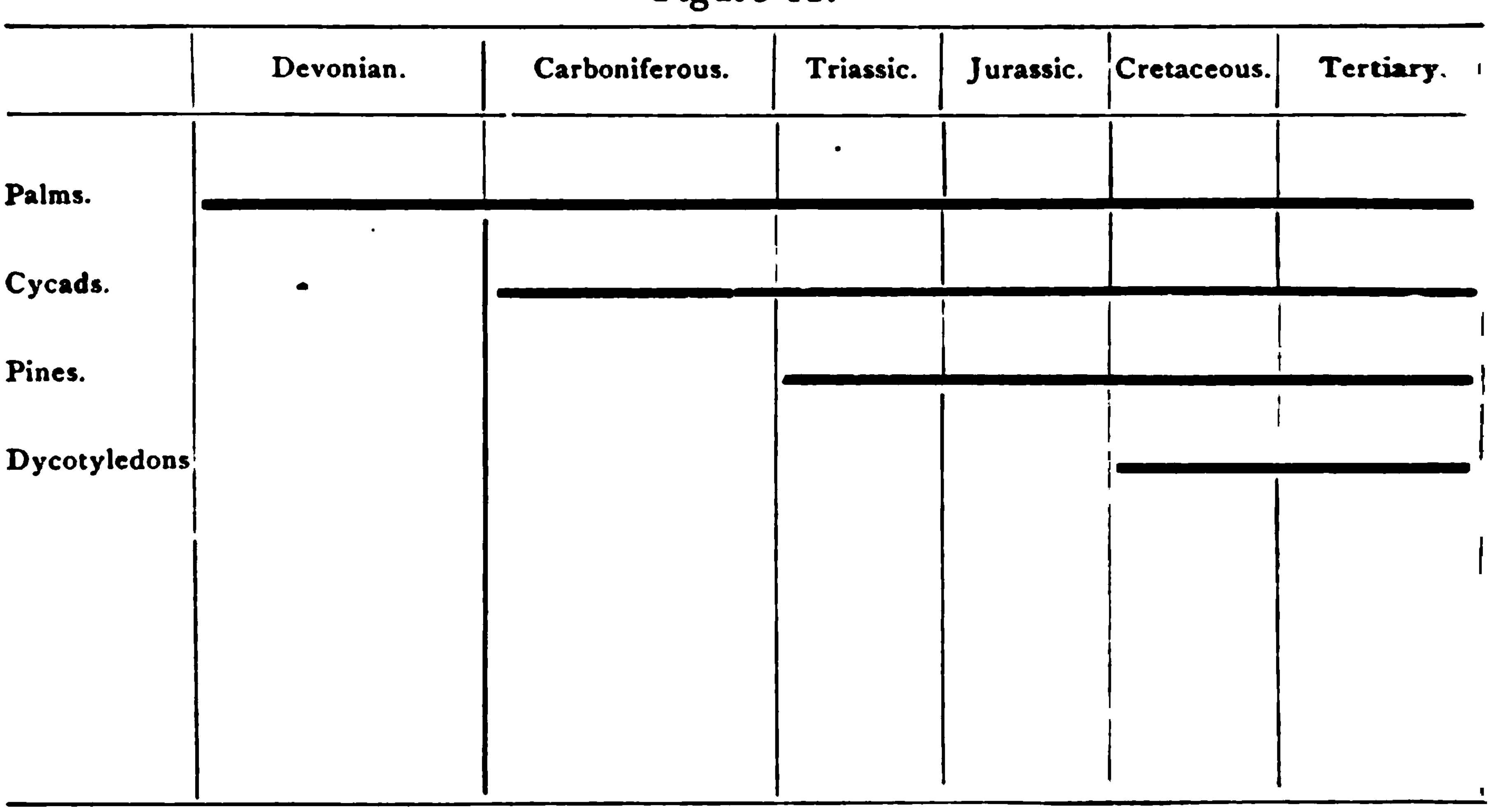


Figure 12.



To show more clearly the contrast between the actual times of the appearing of the trees of different families, and the theoretic times in which they should have appeared, we give two diagrams, or figures. Figure 11 presents the true history according to the evidence of fossils, and figure 12 gives their relative order of birth according to the theory of evolution. The facts and theory, it will be clearly seen, are in strong contrast.

These figures begin with the Devonian Age, or the latter half of the earth's history. We omit the Silurian, as the ocean then covered so much of the surface of the globe that none but marine plants had opportunity to grow. It will be seen that the Palms and Dicotyledons came in together, when by their rank they should have been at the extremes. The Pine is about four times as old as the Palm, when it should be less than half as old. Or, if we compute by years, the Pine has existed for not less than twenty-four millions of years, and the Palm six millions of years. In figure 12 we do not pretend to give an accurate rank of the trees, as no standard can tell us how much the Oak outranks the Pine, or how much below the Pine we must place the Palm. But it may be considered a fair approximation.

We do not forget that we shall be reminded of "the great imperfection of the geological record," and that we have not yet discovered all the fossils of the old Flora. But the number of species of fossil plants now known and described is over 7,000, of nearly 900 genera. There is now no more proof that these chasms which connect the extreme forms will be bridged over, than when one-seventh of that number was known. There are no more species, showing a development from a low to a higher type, than when Professor Darwin first began his labors. On the other hand, all the recent discoveries have settled the question most clearly, that in plant life there are no forms which have been derived from a lower, or developed into a higher, organized plant.

(*To be continued.*)

THE HOME OF THE MASTODON.

New York has always been historic ground for the mastodon. The earliest account which we have of the remains of this animal is found in the "Transactions of the Royal Society of London for 1714," where it is stated that two large teeth and a femur were found at Claverack, N. Y., in 1705. From that time until the present day, skeletons or parts of skeletons have frequently been unearthed in that portion of the State lying west of the Hudson. The finest specimens in the museums of this country have been found in New York, and two of them, at least, in the immediate vicinity of the Hudson. The very perfect skeleton found near Newburg in 1845, on the farm of Mr. Brewster, and now generally spoken of as the Warren mastodon, is at present in the Boston Museum. The Cohoes mastodon, which was brought to light in September,

1866, on the grounds of the Harmony Mills Company, is also quite perfect, but was not found in the place in which the animal died. The bones were taken from a large pit in the rock, evidently formed by the wearing into each other of a number of pot-holes, forty feet in width and of about the same depth. They were imbedded in turf or peat, which contain many fragments of wood, some of which were so well preserved that they were identified as white pine, hemlock, black spruce, larch, swamp maple and white birch. It was conjectured that during a freshet some large beaver dam had been swept away, and the rush of water had carried along the loose bones which. falling into the cavities in the rock, were there preserved for ages, to be finally unearthed and placed in the State Museum at Albany. The last important skeleton came from Otisville, in Orange county, where it was discovered in 1876. It is now in the Peabody Museum of Yale College, and is very nearly complete, only the tusks, hind legs and tail being wanting. The tusks will probably never be recovered, as the chances are that they have rotted, and, if found at all, will be in a fragmentary condition. The legs and tail, however, will no doubt come to light when further excavations in the swamp shall have been made. The bones of this skeleton are not at all changed; that is, they are still bone, although they have lost some portion of their animal matter. Indeed, mastodon bones in this country are not usually petrified, for the mastodon was, geologically considered quite recent. Preglacial he was, of course, for specimens from the Big Bone Lick in Kentucky, consisting of bones, tusks and molars, show marks of the journey in the ice, being much scratched and worn.

But in this country the true proboscideans seem to have made their appearance in the later tertiary, and to have become extinct before the historic period. This is. of course, only another way of saying that we know nothing about when they did disappear from the land. The history of America begins substantially with its discovery by the whites, so that we have as yet no certain means of knowing whether the primitive man of America once hunted the elephant and mastodon or not. It is hardly doubtful, however, that man and the proboscideans were co-temporaneous on this continent. It is true that the evidence by which Dr. Koch claimed to have proved this fact beyond a doubt has been shown by Prof. Dana to be at best very untrustworthy. Koch claimed to have found bones calcined by fire as well as to have discovered flint weapons mingled with portions of a skeleton in a swamp. The fact, however, that one or two specimens of antique aboriginal pottery have been found ornamented with unmistakable figures of an elephant's head is very important, and unless it could be explained away by showing that the pieces supposed to be ancient were really modern, would have great weight. The evidence adduced by Professor J. B. Whitney, in his very important work on the "Auriferous Gravels of the Sierra Nevadas," appears to establish pretty satisfactorily the contemporaneity of the two species. If this evidence can stand the criticism to which it will, of course, be subjected, and should be generally accepted, as it probably will be, then man

on this continent extends back to the pliocene, and was thus for a long period coeval with the mastodon and elephant. In Europe the mastodon has been found as far back as the miocene, or rather in beds that have usually been considered as miocene, though some geologists are at present disposed to regard them rather as early pliocene. There is good evidence that the troglodytes of Europe knew the mammoth, at least, for rude but characteristic sketches of the huge beast on bone and stone have been found in ancient bone-caves, and, with similar drawings of the horse and other animals, show not only that the early man was well acquainted with the creatures which he represented, but also that he had ideas, crude enough to be sure, but still ideas, of art.

Neither the mastodon nor the elephant was common in New England and but very few remains have been found east of the Hudson river. It seems probable enough that this stream formed a barrier to their eastward extension which they could not surmount. Westward they are found even to the Pacific coast, their remains being more or less abundant in Kentucky, Ohio, Kansas, Missouri and Nebraska, and in Washington Territory, Oregon and California. Big Bone Lick, in Kentucky was a vast cemetery for this gigantic race, and their remains abound in the pliocene and quaternary beds of the trans-Missouri country. The superb specimen discovered by Dr. Koch, and now one of the most imposing fossils in the British Museum, came from Missouri. Numerous specimens of these animals have been found in South America.

The mastodon recently exhumed at Newburg was found in the same swale from which the famous Warren skeleton was taken thirty-four years ago, but about three miles further south. Comparatively little digging has been done as yet, and the hole from which the bones came is only about ten feet by twenty in size. The story of the discovery is briefly as follows: On Saturday the sons of Mr. Kelley were digging a ditch about 100 yards behind the house, partly for the purpose of draining a piece of land on which they had planted some potatoes, and partly to make a barrier to separate the potato field from the pasture which adjoins it. While at work here their tools struck what they supposed to be one of the logs which occur so commonly in the bogs in this region. After getting it out of the ground they hammered it with their spades, breaking it somewhat, and finally decided that it was bone. It was one of the humeri of the mastodon. Further digging brought to light some vertebræ, fragments of the neural spines, etc. The boys did not think much of their discovery, but chanced the same evening to speak of it to Mr. R. W. Genung, who, the next day, with the assistance of some neighbors, got out all that has as yet been unearthed. As soon as they got down a few feet the water gained on them so rapidly that they were obliged to stop digging, and nothing has been done since Sunday toward continuing the search. In fact, just at present they are too busy gathering in the quarters to do much for science. The little room in the barn where the bones are on exhibition, though never crowded, often has a dozen people in it, and as they are coming and going all the time, the daily receipts must reach quite

respectable figure. Mr. Genung has constituted himself showman, and points out the beauties of the specimen in a very enthuiastic and often amusing fashion. An examination of the hole from which the bones were taken shows at the surface a few inches of dark soil, beneath this from eighteen inches to two feet of peat and fine roots, then two feet of black mold interspersed with small fragments of rotten wood. Beneath the black earth is a tough, bluish clay containing a good many gravel stones. The skeleton was found in the black earth above the clay. This clay is said to be underlaid by a fine white sand. No shells were found, nor did my examination of the dirt thrown out reveal any. The skull of the specimen pointed toward the west, and the skeleton is said to have been a good deal disarranged, the hind legs being near the head and some of the ribs being twelve or fifteen feet away from the main congregation of bones.

Ninety-two bones are said to have been discovered, and this number no doubt includes all the fragments picked up. Of the vertebræ there are but eleven having the center preserved, viz.: One cervical, four dorsals, four lumbars, and two caudals. There are besides these a few spines and neural arches. The vertebræ are most of them a great deal decomposed, as they were probably nearer the surface of the ground than most of the other bones. The atlas, however, is perfect. One scapula is present and in good condition. The pelvis is missing, as are most of the meta-carpals, meta-tarsals and phalanges. Both astragali are present and one calcanum and quite a number of the carpal and tarsal bones, but not enough to make up a perfect foot. All the bones not specially mentioned are present. The specimen appears to be the common *Mastodon giganteus* of Cuvier, and is fully adult, as is shown by the condition of the bones and the wear of the teeth. It is not a very large specimen but most of the bones are well preserved. They are not all mineralized, various reports to the contrary notwithstanding.

[*N. Y. World.*

FOSSIL SPONGES.

S. S. Wallace has examined the geodes found in the Keokuk (Lower Carboniferous) limestone over a great area in the Upper Mississippi valley. They are shells of chalcedonic silica of from a few lines to two feet in diameter, sometimes empty, but at other times filled with agate, crystalline quartz, or calcite, and have long been suspected to be organic in origin. Wallace has confirmed this view, and shows them to have been castes left by the decay of sponges, of which they often bear the outward markings. He has described several species which he refers to a new genus, *Biopalla*. These sponges are seen to have grown in some cases over and around projecting masses of rock, and, in one case, within a large crinoidal column, which had been split open by the growth of the sponge.—*Annual Record of Science and Industry.*

ARCHÆOLOGY.

ARCHÆOLOGICAL EXPLORATIONS IN TENNESSEE.

BY PROF. F W PUTNAM, PEABODY MUSEUM.

(*Concluded.*)

Scattered irregularly within the inclosure are nearly one hundred more or less. defined circular ridges of earth, which are from a few inches to a little over 3 feet in height, and of diameters varying from 10 to 50 feet. The best defined of these

Fig 87

Jar from grave, Burial Mound within Earthwork. ½.

little mounds was that marked *B* on the map. An examination of these numerous low mounds, or rather earth rings, as there could generally be traced a central depression, soon convinced me that I had before me the remains of the dwellings

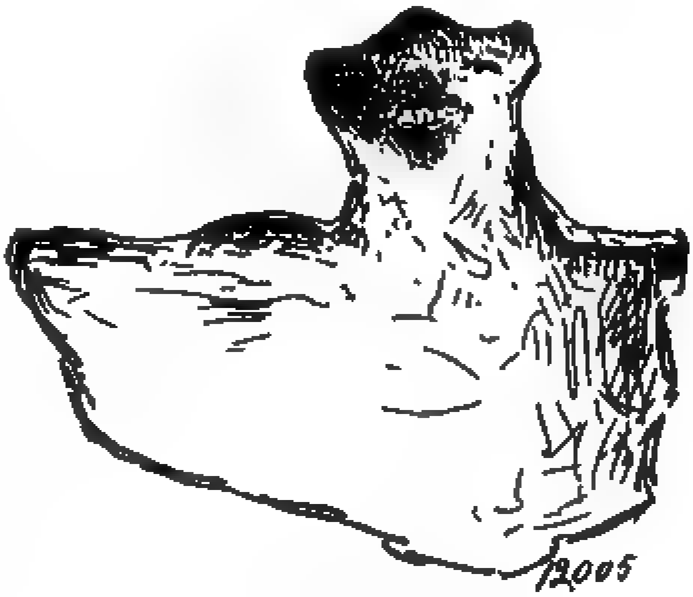
Fig. 38.

Jar from grave, Burial Mound within Earthwork. ½

of the people who had erected the large mound, made the earthen embankment, buried their dead in the stone graves, and lived in this fortified town, as I now feel I have a right to designate it.

Nineteen of the best defined of these earth circles were carefully explored with very gratifying results, and proved to my satisfaction that the ridges were formed by the decay of the walls of a circular dwelling, about which had accumulated, during its occupancy, such materials as would naturally form the sweepings and refuse of a dwelling of a people no further advanced towards civilization than were these Mound-builders of the Cumberland valley. These houses had probably consisted of a frail circular structure, the decay of which would only leave a slight elevation, the formation of the ridge being assisted by the refuse from the house.

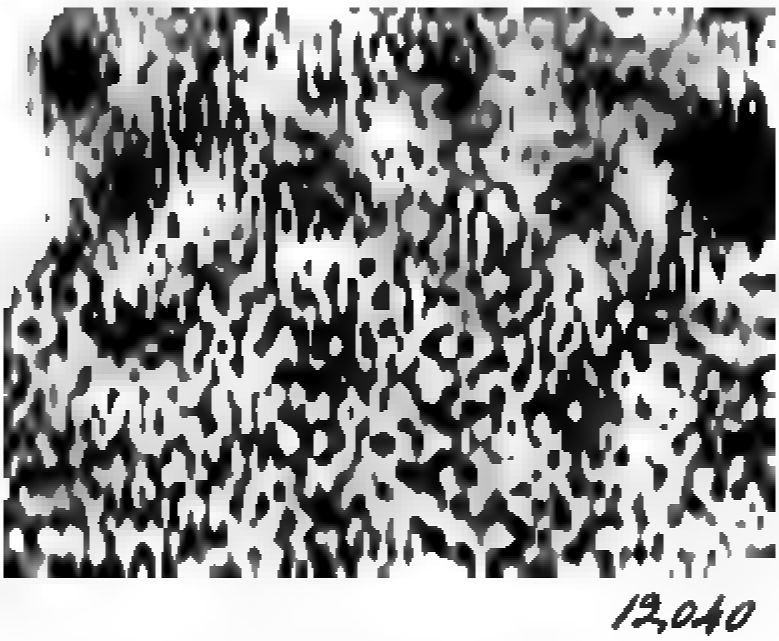
Fig. 39



Fragments of Pottery from grave, Burial Mound within Earthwork. Natural size.

After the recent soil within the ridges had been removed, hard floors were discovered, upon which fires had been made; while in the dirt forming the ridges, were found fragments of pottery; broken and perfect implements of stone, several discoidal stones, most of which were made of limestone; bones and teeth of animals, charcoal, etc.

Fig. 40.



Pipe made of Slate, from grave, Burial Mound within Earthwork Natural size.

On removing the hardened and burnt earth forming the floors of the houses, and at a depth of from one and a half to three feet, small stone graves were found in eleven of the nineteen circles that were carefully examined. These graves were in every case those of children, and were from one foot to four feet in length. In some the bones were entirely decayed, in others a few of the more solid parts of the skeleton such as the shafts of the long bones, the central parts of the vertebræ, and fragments of the crania were preserved.

The tibiæ of one young child in particular are worthy of remark from their extreme thickness and great curvature. These tibiæ of children are not in the least flattened, though some of the tibiæ of adults from the burial mound are.

These children's graves were found at one side of the center of the house, and generally, it was noticed, that a fire had been built over the spot, as shown by the

Fig. 42.

Side view of figure 41.

Fig. 41.

Pipe carved from Steatite, from Burial Mound within Earthwork.

burnt earth and charcoal. From them were obtained the best specimens of pottery found within the earthwork, with shell beads, pearls, and polished stones of natural forms, etc., which were probably playthings. In several of the smaller graves were the metacarpal bones of birds, which may have been given to the children to aid the teeth in perforating the gums, as is stated to be the custom among some of the present Indians.

Three small discoidal stones were picked up in the ridges of as many different houses, and one other was found on the hard floor, while still another was discovered in the burnt earth over a child's grave.

In the dirt forming the ridge of the house designated as No. 3 in my notes, and under the floor of which graves were not found, was a fragment of thick pottery (Fig. 44) with the impression of a closely woven fabric of coarse threads. Near this was taken out a bowl (12046) with rudely scalloped edges, of which figure 45 is a representation. From the same place was also taken a rude celt (Fig. 46), made of sandstone (12047).

Fig. 48.

Back view of figure 41.

Under the floor of one of the houses was a small grave containing the remains of the bones of two children, and with them the dish (12072), of which figure 47 is a drawing. No other article was found in this grave, over which a fire had been made, and in the ashes were burnt animal bones, a discoidal stone and several fragments of pottery. Within the area covered by another house, three burials had taken place, and from these graves were obtained two earthen vessels, a discoidal stone, a dish, and a few shell beads.

Three other houses contained graves of children in which were found several articles worthy of note, and evidently of considerable value. Under the floor of one of these houses, two graves were discovered, one of which was made simply by placing two stones about eight inches apart, and was without the usual pavement at the bottom, or the covering and end stones. This contained the remains

Fig 44.

Fragment of Pottery from refuse of a House within Earthwork. Natural size.

Fig. 45.

Bowl from refuse of a house within Earthwork ½

Fig. 46.

Celt of Sandstone from ridge of House within Earthwork Natural size.

of an infant buried in ashes, though the bones were not burnt, and two broken vessels of ordinary form.

In the other grave was a similar vessel (12062, Fig. 48), an awl or pointed implement of bone (Fig. 49), and another made of deer's horn, the leg bone and a vertebra of a bird, and five shells of *Unio*.

Another house, located near the large mound, contained two graves, in one of which was found a water jar mounted on three hollow legs, the cavities of which connect with the body of the jar, while the cross bars between them are solid. This jar (12093) is shown, of one-half its diameter, in figure 50.

The other grave in this house was remarkably rich in relics, and contained an earthen pot (12086), a bone of an animal (12087), the shell of a *Unio* (12088), two large shells of *Busycon* (12089) from the Southern Atlantic coast, from which the columella had been removed and a large lot of small shell beads (12091), of

Fig. 47.

Dish from grave of a child in a House within Earthwork. ½

which six hundred and fifty were collected and many more were in fragments. These beads would have formed a chain several feet in length, as one hundred of them measure eighteen inches. With these shell beads were seven perforated pearls (12092) of large size, among them one which is nearly one-half an inch in diameter; also several handsome pebbles (12090) of quartz, chalcedony, etc., and a piece of the stem of a fossil crinoid.

Fig. 48.

Pot from grave of child in a House within the Earth work. ½.

The last of the houses examined, which was also located near the large mound, contained the graves of an infant and of two other children. In the grave of the infant, the only article found was an earthen pot (12101), represented by figure 51. The second grave contained a dish (12096), and the small pot (12095) with ornamented edges, shown in figure 52. The third grave was remarkable for the three well-made articles of pottery which it contained. These are represented, of one-half their diameter, by figures 53, 54, and 55. The pot shown by figure 53, is a symmetrical vessel, with deeply scalloped edge and with a projecting portion under each point of the scallop. Figure 54 is a well executed design of a duck shaped bowl, while figure 55

Fig. 49.

Implement of Bone, from grave of a child in a House within Earthwork.

represents a water jar in the form of a bear. This last is the only article of pottery obtained within the inclosure at Greenwood that was not of the ordinary blue gray color, like the majority of the pottery from Tennessee, Missouri, etc. The surface of this jar is of a yellowish color, and on this had been painted a number of concentric figures, which were perfectly apparent when

Fig. 50.

Jar from grave of a child in a House within Earthwork. ½.

Fig. 51.

Pot from grave of a child in a House within Earthwork. ½.

the jar was first removed from the grave, but as they had not been burnt in, they scaled off in drying and are now only faintly indicated. This interesting jar, with others that are here figured, is evidence of the high attainments of this ancient people in the ceramic art, and shows the development reached in native art by people who worked in copper, carved in stone and shell, moulded in clay, wove fabrics of several kinds, cultivated maize, lived in walled, or fortified towns, buried their dead in an extended posture, generally in stone graves, and erected the large mounds of the Cumberland valley, from which they are now known as the Mound-builders.

Fig. 52.

Pot from grave of a child in a House within Earthwork ¼.

Fig. 53.

Pot from grave of a child in a House within Earthwork ½

Duck shaped Dish from grave of a child in a House within Earthwork. ½.

Fig. 55.

Fig. 56. Painted Jar, from grave of a child in a House within Earthwork. ½.

POLITICAL SCIENCE.

BRITISH IMPERIALISM AND THE AUTONOMOUS RIGHTS OF RACES.

BY A. H. THOMPSON, TOPEKA, KANSAS.

(*Continued.*)

It is a well known fact that racial characteristics are very persistent in all peoples, and give them an ethnical cast, utterly unmodifiable so long as racial purity is maintained. It is well known also that mental characteristics, all moral or emotional peculiarities, are engrafted upon, formed and controlled by physical characteristics, and that the two are inseparable, co-ordinate and persistent. This permanence and tenacity of ethnical features, is due to the long practice of peculiar habits, amid peculiar circumstances and environments, during the development of the species in what we are pleased to call "pre-historic times."

With most races of the human family, this period was during the incalculable æons geologically known as the tertiary and quartenary periods. This was undoubtedly the childhood of the species—the impressible period. We are only too well aware how impressible the young, the child of our species is, and how permanent and potent for the moulding of all after life are those impressions. Believing that the child is the anologue of the growth of the species, that the individual of every animal kind in its physical and mental development passes through the same stages in its growth, as those which marked the eras of the development of the species, we cannot but conclude that the life histories of the two are strictly analogous, and that as a result the peculiarities of races, physical and mental, are the product of impressions received and habits formed during the infancy and childhood of mankind. Then, external influences and internal effects co-operated to develop the phenomena of organziation peculiar to each race. Those impressions manifest themselves in physical and physiological peculiarities, habits of thought, feeling, morals and beliefs; in the customs of the common life of the individual, the family and the people, in society, government, etc., as well as the casts and modifications given to language and religion, and in all that is at all peculiar or indigenous to a people. Language and religion are not included among the special peculiarities, because these are but rarely indigenous to a race, but are usually imposed by foreign, conquering peoples and are consequently arbitrary; and yet when so imposed are always modified by the customs and mental habits of the people before complete adoption. To most ethnical phenomena, however, this rule does not apply, and under the coercion of unwelcome innovation, many races have gone down to utter extermination before the forcible imposition of things so foreign to everything in their lives that they were

incapable of adaptation to them. This is noticed in races which have, as they always do under such circumstances, on the removal or relaxation of coercing power, reverted to their original, natural habits and customs, in which they are most happy and prosperous. This is exemplified also in the individual, who returns to the habits of childhood as most natural, after having lived to him, an artificial life which differed from it, and this is equally true of races. Those things to which a race has been accustomed for ages, it matters not what they are, are to them the embodiment of all that is perfect and natural, and all that is foreign to them or their experience is most unnatural, strange, repulsive and even ludicrous. It is the same spirit in individuals which dubs the habits or tastes of others as "queer," merely because those peculiarities are foreign to their own experience, and not suspecting that they are "queer" to others in turn. We have heard of savage and degraded people who looked with pity and wonder upon Europeans because of their strange customs, ludicrous ways and white skins. It appears then that the value of all things pertaining to man is only comparative, be he savage or civilized, and depends only upon the education and preferences of a people. Preference for tribal, indigenous customs, etc., becomes a passionate attachment, things to which they are accustomed being endeared by association and most conducive, with them, to happiness and prosperity. The practice of habits or customs elevates them in time into a second nature, and anything in the way of a forcible alteration of them assumes the potency of a disastrous revolution which brings only evil and misery.

Here we would make the first rule of conduct, which must be named the *negative duty* of the higher or stronger nations, to the lower or weaker; *i. e.*, that no race has any moral or other right to interfere with the habits, customs, government, etc., of any other race and impose upon it things strange and repulsive, merely because the stronger race happens to be attached to those things and thinks them best. Civilized nations should not attempt to force their own customs, institutions or government upon other peoples, whether savage or not, because they are differently, perhaps inferiorly constituted, and on account of such difference or inferiority are incapable of understanding, appreciating or adapting themselves to civilized institutions. Every people, savage or civilized, understands and enjoy only the things to which it is accustomed. But too little account has been taken of this principle by European nations, who, in their own ignorance and conceit, imagine that because certain institutions are theirs, and are useful and agreeable to them, that they should be adopted by all other peoples indiscriminately, irrespective of the possibility of different tastes, capacities and peculiarities. Some of them have partially discovered this mistake in their dealings with Asiatic people, whose modes of thought, etc., are as different from European as that of one species of animal from another.

The different altitudes of intelligence and mental capacity of various races, have much to do with the comparative value of institutions. In the matter of the form of government, it does not hold that because the Republican is that

which is best for the highest and most intelligent people, that it can be applied to all races, irrespective of intellectual capacity. For the fact is, that the earliest, the primitive form, *i. e.*, the patriarchal and tribal, is yet the best for simple and savage people. The forms of government are graded in corresponding ratio to the development and stages of intelligence of races, through various appropriate modifications, from the patriarchal up to the republican. As man still progresses and unfolds, we believe a yet higher form will be developed as he becomes less and less brutal, more intelligent and more capable of self control. The higher classes of Indo-European races have outgrown the tribal and even the monarchical forms, but the masses are yet incapable of the merest self control, thus keeping the average low, while many of the most degraded classes, even of the Anglo-Saxon blood, are not above the patriarchal and despotic. The right to vote is to them a mere novelty—they do not understand it. The savage does not comprehend the higher, the European forms, and will rarely flourish under them, unless with a compromise government. The simplicity of the tribal and despotic system is best suited to his childish and primitive cast of thought, and he must be let await intellectual development and civilization before being called upon to adopt and flourish under anything higher. The same may be said of customs and domestic institutions.

The love of a people for their *racial* government—their own form, their own rulers—is proverbial, and is another and humane reason why it should not be interfered with. This love of country and government has led to the universal willingness amongst men to fight and die for it, and this devotion is dignified amongst the higher nations by the name of *patriotism*. In addition to natural affection for their country, all men have a strong intuition that racial rule is *right*, and control by a foreign power is a wrong that cannot be borne. The imposition of foreign rule has been the most prolific cause of bloodshed and misery the world has ever known; for men fight more savagely in defense of home, country, racial customs and government than for any other cause. The finest heroism has been exhibited by patriots, as well as the most wonderful examples of unmurmuring endurance of suffering and hardship. All these are because foreign rule is naturally odious to all people, even when it is accompanied by greater security to life and property. Patriotism is rarely developed for a government foreign to a race and never of any depth; and a good opportunity to throw off the yoke of the usurper, and reinstate their own rulers and gain racial independence, is never allowed to pass without an uprising, so long as the original racial characteristics remain in any strength amongst a subjugated people. All people have an inherent intuition that independence and autonomy are birthrights in a race, and the recognition of this feeling as a living, moral principle of right amongst nations would lead to untold happiness and prevent untold misery, both to the conquering race and the conquered. Let the nations and races permit each other to govern themselves, to please themselves, and who can estimate the happiness which will spring from the adoption of the law, when all people will be free from the fear of foreign con-

quest. There will be little or no war and consequent absence of the miseries springing therefrom; there will be few armies and absence of oppressive taxes to support them, and peace will promote industry and wealth.

Besides the ethnical and humaritarian objections to the policy of foreign conquest by any nation or race, there is also that of common moral right. As before remarked, compared with laws and actions between individuals, and judged according to the common rules of right, the conquest of one race by another is simply highway robbery, with the additional crime of slavery. The robber of men merely takes his neighbor's money or goods, and, if he does not resist, rarely murders him. But the conquering nation, not content with taking and appropriating the territory belonging by right to another race, robs that race of freedom as well and places ownership over both person and property. The people are held as chattels by the conquerers, practical if not nominal slaves. They are not of the conquering race and have no part or voice in ruling their own country. Citizenship, when bestowed upon them, amounts to nothing, for governing power or voice in government is kept from them, while under their own rule they were part of their nation had,a voice in its affairs and an interest in the general ownership of the soil. Under foreign rule, however, none of these rights are recognized or prevail, because such recognition would naturally imperil the ruling power. The soil belongs to the conquering rule, and the conquered people hold and cultivate it merely for the benefit of the conqueror. They are slaves attached to the soil; their persons, their labor, their property belonging to another.

Passing now, for a moment, from the negative duty of the greater to the lesser nations—of all races to each other—let us introduce another, the *positive* duty, especially as applied to the civilized nations in their care for semi-civilized, barbarous and savage people. This duty is a positive one, as opposed to the negative duty of non-interference, inasmuch as it requires active interposition in the affairs of wild or cruel people, *merely* to (1st) prevent and restrain them from murder, cruelty, slavery and oppression, and (2d) to educate them in the elements and principles of civilization and Christianity. The two duties do not, as may at first appear, negative each other, but are mutually helpful.

Under the first head of the positive duty, there would be direct interference by force of arms by civilized nations for the prevention of cruelty amongst savage people. No matter what the source of cruelty or its form, whether from customs, religion or despotic government, it is productive of misery and should be prevented (except when inflicted as a punishment for actual crime,) at any cost short of cruelty in the enforcement of the protest, and this for the sake merely of humanity and common brotherhood. Under the second head, teachers and missionaries should be maintained by civilized countries, amongst ignorant and savage peoples, to instruct and educate them in the knowledge of the world, science and Christianity. But the education must not be compulsory beyond the forcible maintenance of teachers amongst such people.

The right to interfere to prevent cruelty is, of course a common one, a duty

of one man or nation to another, and if the giving of power and civilization, of mental and moral elevation to a nation, means anything, it means that they should be employed for the benefit, the promotion of the good of people less fortunate. England, it is true, makes this claim as her right to subject wild and savage people to her political rule; but while she protects them she does not educate or elevate them, and, besides, she vio'ates the first law of right between races in depriving the weaker of autonomy, and imposing her own rule—in making of their country British territory. This is a crime, and *she inflicts* bloodshed and misery in order to its commission. Her political rule is absolutely unnecessary and is hurtful to the people subjugated. Interference merely to the extent of preventing cruelty and of educating them, letting them govern themselves, to please themselves so long as they abstain from cruelty, would accomplish the same benefits to her trade and much more good to the natives. But British ambition could not be satisfied, or British pockets be filled so rapidly, and "there's the rub."

This surveillance of civilized, Christian nations over the savage, weak and ignorant, must be in the nature of a *civilizing protectorate*, its object to shelter and protect them from themselves and others, and to educate and elevate them, that they may themselves, in time, become civilizers in turn. By the establishment of this principle many a picturesque and interesting people would be preserved in prosperity and happiness, to do good and be blessings among nations. All the bloodshed and misery attendant upon those destructive wars of conquest would be avoided, and patriotic, racial rule prevail everywhere. It is improbable that any people would resist, to any serious extent, the teaching and enforcing of mercy and kindness by a stronger power, when once the purpose of interference was understood, and that it was not political conquest. The superior power would teach the inferior self government and erect only racial rulers to control, and this, with education of the people and the check put upon cruelty, would contribute as nothing else could, to the health and development of physical, mental and moral life of a high type, and could only result in happiness and good. The achievement of these results would of course, be slow; the lifetime of generations might be necessary before permanent benefit could be guaranteed to a people and they be left to themselves, the rate of progress varying, of course, with the capacity of races for receiving instruction. The education would, also, not overthrow native and domestic institutions, but merely modify and elevate them.

The curse of most savage countries is witchcraft, fetich worship and superstitions, which are inseparably accompanied by much cruelty and suffering, both physical and mental. Overpowering fears haunt the poor savage by day and terrors by night, without cessation, such as the people of civilized lands know nothing of. It is not always the fear of physical death or torture that makes him miserable, but even when not under persecution, real or imagined, he has ever present with him the dread of cursings and witchings or terrible calamities, the like of which his imagination cannot picture to him. All people have passed through the long stage of the rule of the terrorism of superstition, and its mark is left upon every race. Superstitions shorn of its terrors, perhaps, still survives amongst all,

even the highest of races, as manifested in the belief in signs, omens, and in other forms. It is the first inceptive belief in the supernatural, and from which the religions of all races have been developed. But in the lowest races it is attended with great cruelty and misery, and the duty of civilized, Christian nations is plainly in the path of elevating and Christianizing the poor savage, in order to the lifting of his soul out of the groveling miseries of his superstitions into the light. Civilization will rid him of his belief in and fear of witchcraft and other ill powers, and evangelization will furnish him with a religion at once elevating and merciful. He will be taught that the ordinary and extraordinary phenomena of nature are not due to spirits, mostly evil, and which can do him only harm, but by knowing the true causes he will come to love and admire what he formerly feared and hated.

In the matter of the evangelization of savages, the Christian nations have a delicate duty upon their hands in regard to missionary effort and religious questions. A religion must not be *forced* upon any people, any more than anything else foreign to them, merely because a stronger nation happens to believe it to be true. Like the teachers of civilization, missionaries of Christianity must be maintained by force, if need be, in savage countries, but the acceptance of their teachings must be optional with the people, and be let grow upon them as they understand and appreciate them. Christian nations, having faith in their religion and being furnished with every proof of its truth which the highest intellectuality can adduce in its favor, are in duty bound, by the nature and teachings of that religion, to propagate it for the good of mankind and the salvation of the world. It is their duty to endeavor to make of savage people better men, and save their souls, and to that end missionaries are sent amongst them The missionary system is still the best for the promotion of the work; but it has become an experimental fact that education and a semi-civilization at least, must precede and prepare the way for a perfect and saving acceptance of Christian teachings. The mental capacity of the savage must be enlarged, and his moral faculties developed, before he can understand and appreciate the principles of Christianity. This has been demonstrated by the sad experience of hundreds of faithful missionaries, who have gone down with broken hearts to the grave, because discovering too late that the wily savage, deceptive by nature, has merely pretended to the possession of the Christian graces, which the missionary pictured to him and desired him to have. He has played the part of the heartless hypocrite, because good actions and words pleased his good friend, the missionary, and the latter, credulous because anxious and desirous, believed the savage truly converted, but at the last found that he had been played upon and deceived. The cause of this unfortunate condition of affairs, only too general in the missionary world, lies in the fact that the mind of the savage is incapable of receiving the higher teachings of Christianity, or to comprehend them, until trained and developed to a certain capacity. The plan of educating before attempting to Christianize, is now becoming more and more the working system of missionary effort, and as such is productive of greater and unmistakable success. The school for children

and the adults who will accept teaching, is now the entering wedge, and conversion and evangelization follow as an apparently natural sequence.

The history of missionary effort amongst savages can, in fact, give us the key to, and illustrate, the better system of dealing with independent and wild people. The true missionary never interferes with politics or customs, except to prevent by his teachings and persuasions, the practice of cruelties, and much good he has done in this way. Civilizing nations should deal with wild peoples in the same way, *i. e.*, by becoming the missionaries of civilization and Christianity, and practicing non-interference in politics and customs, *except* to prevent cruelty. The people would probably accept of their ministrations eagerly, when convinced of them being only for their good and of the good faith of the missionary nation.

It can scarcely be questioned that the time has fully come when nations should lay aside all selfishness and deal more honestly and justly with each other. But the so-called practical, the main objection to be made to the principle here proposed is, of course, that "it would not pay" the nation endeavoring to inaugurate and put it in practice. The immediate expenditure and outlay on the part of the government, or private enterprise of a people attempting the establishment of the system would, of course, be considerable, and would not be returned, at least in direct revenue. But yet in time, the benefits arising from trade would be just as great, if not greater, than if political supremacy had been first established, which, with the forcible maintenance necessary afterward, is itself a most expensive luxury to any nation. In the case of Great Britain and her acquisitions, we cannot but believe that she would have expended sufficiently less of blood and treasure by merely maintaining small armies for the prevention of cruelties, etc., in those conquered countries, to have more than compensated for the cost of original conquest, the suppression of righteous rebellions, the carrying on of English government and law, and trade be what it is, or better, without forcing. All that has been gained over and above the cost of governing, in revenue, commercial advantage or glory, is not a sufficient compensation for the cost of conquest in misery to British subjects, blood and money. It would have been much cheaper to have established and maintained a civilizing protectorate, under which trade could have been carried on with fully as much success and safety, and more honestly, and have left the governing of the people to themselves, who would have done it better. There would necessarily have been little or no resistance, for freedom and independence would not have been interfered with. The task of governing people for which Europeans are totally unfitted, would have devolved upon the people themselves, who would have had all the labor, difficulty and responsibility. As to revenue, we find England this year in the extremity of appropriating funds from the home treasury, for the maintenance of the Indian army and government, the taxes of that vast and populous region, burdensome as they are to the people, not being sufficient to meet the expense of occupation and public improvements, the latter, as railroads, etc., being necessary for the efficiency of military control. The working of all the departments of the government of India, requires an army of men, military and civil, and all

this, with its endless burdensomeness and failure and disappointment, with its needless expenditures and follies, its crimes and wrongs to natives, might be swept away, by the adoption of racial rule, and British commerce not suffer in the least. The entire revenue does not now meet the expenses of ruling, and all the satisfaction or reward to be gotten out of English possession seems to be the glory of British dominion!; a very poor return indeed for all the expenditure for conquest and the cost of subduing such righteous rebellions as the Mutiny, with their attendant miseries to both conquerors and conquered.

The annoyances and difficulties of governing nations and peoples to whom the conquerors are ethnical strangers and antithetical at every point of mind and character, has been demonstrated by the experience of European nations with Asiatics. Under the philanthropic system all these difficulties would be turned over *in toto* to the native rulers, who, even with less intellectual capacity, could do the same work with more ease and more satisfaction to the people, than foreigners. The intuitive agreement and understanding between people and rulers when of the same race, is at once natural and obvious. The objection that may be made to the *quality* of native government, when compared with the higher European forms, does not stand, because the native government will necessarily be that form to which the customs and capacity of the people conform, and which they can alone understand. A higher form may be better for a people of higher intelligence, but for those of lower intelligence the lower systems are better. The same may be said of systems of laws. England, for instance, persists in the imposition of her own laws upon people whose needs are utterly misunderstood, and the application to them of her laws works mischief and injury. But instead of learning to appreciate this by perpetual failure to administer justice, the stupidity still goes on. How long will nations be in learning that the laws and government which each race makes for itself, are the best suited to the circumstances, customs, intelligence and character of that people, whoever they are, are the best understood and productive of the most good! and that the same government *cannot* be applied to another race with success and benefit.

(*To be concluded.*)

Professors Ayrton and Perry, of the College of Engineering, Tokio, Japan, communicate to the *Philosophical Magazine* a short note, proposing the hypothesis that the phenomena of earth currents, terrestrial magnetism, and atmospheric electricity are due to the fact that the earth is an electrified condenser, whose capacity or potential is continually changing on account of its rotation and its annual orbital motion, the successive cooling and warming of the air, the formation of clouds and rain, etc., etc. These changes produce electric currents tending always to restore the equilibrium, whence follow the phenomena in question. They suggest that observations of atmospheric electricity may be used to predict atmospheric changes.

GEOGRAPHICAL NOTES.

GERHARD ROHLF'S AFRICAN EXPEDITION.

Probably never before in the history of African exploration have so many different expeditions been simultaneously engaged in penetrating the interior of the "Dark Continent" as at the present time, and if the success of the explorers prove at all equal to their exertions the last white spot will soon disappear from the map of Africa. A summary of the various expeditions now on the march must therefore be of interest to all readers concerned with the geographical research of our globe.

The only expedition which has taken the Mediterranean coast for its starting point is the one sent out by the African Society at Berlin, under the command of the well known Gerhard Rohlfs. The latest news from this explorer is as follows: The expedition left Tripolis on December 18, 1878, consisting of three Europeans, two German servants, thirteen native followers and twenty-two camels, and arrived at the oasis of Sokna, which lies some 600 kilometers southeast from Tripolis, at the foot of the Black Mountains, on January 24. After a six week's stay in camp, waiting for the German Emperor's presents for the Sultan of Wadai, Rohlfs continued the march due east to Jalo, distant eighty German miles, where he arrived in the first week of April. He traveled to this place by a new route, and visited on the way two new oases, which were previously unknown. He will now have to cross a tract of sandhills, eight days across, in order to reach the oasis of Kufarah, which lies seven camel's marches or eighty kilometers, due south of Jalo, and has never before been visited by a European. He had not yet succeeded in obtaining guides, as none were willing to enter the service of Christians, and he may have to buy slaves acquainted with the road. From Kufarah he intends to push on south to Wadai, and thence to the great bend of the Congo.

EXPEDITION FROM THE EAST COAST.

Ever since the days of Burton, Speke and Grant the east coast of Africa, and especially the island of Zanzibar, has been the favorite starting point of exploring expeditions for the interior. Cameron and Stanley both commenced their memorable journeys there. At present there are also several expeditions which have chosen Zanzibar as their base. The Belgian expedition, sent out by the International African Association, under the presidency of the King of Belgium, has thus far been conspicuous for the ill luck that has attended its march.

Two of its members, Captains Crespel and Maes, died soon after arriving at Zanzibar. Lieutenant Cambier and Marno, the Italian traveler, then made a preliminary expedition as far as Mpwapwa, on the road to Lake Tanganyika. They left Saadani January 21, and returned to the coast March 5. Marno then returned to Egypt on account of some disagreement, and Cambier took command. On July 4 last year he left Bagamoyo for the interior accompanied by Dr. Dutrieux, who has resided at Cairo for five years as physician, and 500 native porters. On the 23d the expedition reached Mwomero, when 325 of the porters deserted with a great amount of baggage. Cambier went on with the rest to Mpwapwa, which he reached August 8, and there waited till Lieutenant Wanthier, another member, arrived from the coast with 360 new porters. Cambier then pushed ahead to Tabora, the Arab capital of Unyanyembe, while his associates followed slowly through Ugogo. On December 19, Wanthier died of dysentery at Hekungu, near Lake Chaya, but Dr. Dutrieux succeeded in joining Cambier at Tabora, where the last advices report the expedition to be waiting for the end of the rainy season before going on to Lake Tanganyika. Meanwhile Captain Popelin, of the Belgian general staff, and Dr. Van Heneel have left Brussels in April last to join and reinforce this unfortunate expedition. There is a belief that Stanley is acting in the interest of the Belgian International Association and that he will either organize a new expedition for this society or accompany the same as leader or interpreter. The general opinion, however, is that his ultimate destination will again be the Congo. He has brought with him a steam launch and a large cutter as well as a great quantity of pierced iron plates for the protection of the boats while passing through hostile regions.

The English Expedition—Death of Keith Johnstone.—Dr. Kirk, the English Consul General at Zanzibar, writes to his government that Mr. Keith Johnstone, the leader of the English expedition to explore the head of Lake Nyassa, died of dysentery on the 28th of June at Berobero, 130 miles inland from Dar-es-Salaam. [Mr. Keith Johnstone was the son of the eminent English cartographer. He was selected as the leader of the expedition sent out by the Royal Geographical Society with the African Exploration Fund. He left England in November last and reached Zanzibar January 5. He first made a short expedition to the Usambara Mountains, north of the Kingain River, and visited Fuga, the capital of that country. He returned to Zanzibar in April, but was prevented from beginning his expedition by exceptionally heavy rains and swollen streams. On May 15, however, he started with 138 followers and crossed over to Dar-es-Salaam, on the mainland, in the Sultan's steamer Star. The object of his expedition was to reach the north end of Lake Nyassa by a new and direct route from the coast, and then explore the unknown tract between that lake and the south end of Tanganyika. Letters from Zanzibar up to the 2d of June reported the final start of the explorer and his party from Dar es-Salaam on the 18th of May. The expedition was to pass up the valley of the Lufigi and its affluents to Ubena, and thence to Nyassa and Tanganyika. Mr. Johnstone was ac-

companied by Mr. Thomson, as geologist, and Chulma, Livingstone's favorite companion, was among his followers. Letters from Zanzibar, dated the 26th of June, reported that Mr. Keith Johnstone, when last heard of, had been making successful progress, having reached a village on the border of a deserted country through which he would have to travel for six days without meeting cultivation. He was then occupied in collecting food to take the party across this desert to Beho-beho, a populous village in Kutu, not far from the Ruaha, one of the two rivers which unite to form the Lufigi. Up to the time of writing he had experienced no difficulty from his porters, but had been delayed by the frequent and heavy rains, which this year have continued longer than usual. Two days later the explorer appears to have succumbed to dysentery, brought on by the miasma produced by the rains.] The expedition will be continued by Mr. Thomson.

A FRENCH EXPEDITION.—A third explorer who has started from Zanzibar is the French Abbe Michel Alexandre Debaize, who has been sent out by the French government with an appropriation of $20,000. In contrast to the Belgians the Abbe has so far been highly successful. He left Marseilles on April 21 and organized his expedition at Zanzibar in less than two months. On July 25 he left the coast and after passing the Belgian expedition on the way, he reached Tabora October 2, without losing any baggage or a single one of his 400 men. On the 16th he passed through Kroikuru, and on April 2 he arrived at Ujiji, on Lake Tanganyika, 250 days from the coast. Stanley, however, when searching for Livingstone, made the same distance, with a detour, in 235 days. Debaize now intends to establish a station at the north end of the lake, which he leaves in charge of reliable servants, while he goes on to the Congo in order to found a second station, with his remaining goods, at the mouth of the Aruwimi. With these two bases of supplies he then proposes to explore the great unknown regions between the north end of the Tanganyika the Congo, the Aruwimi and the south end of the Muta Nzige Lake, which now form a white spot on our maps.

MISSIONARY EXPEDITIONS.—Several missionary expeditions have also started from the east coast. The London Missionary Society last year sent out the Rev. Messrs. Thomson and Hutley, with Mr. Hoar as scientific member, to Lake Tanganyika. They succeeded in reaching Ujiji on August 23d, and established a station on Kigoma Bay, three miles distant. In October, however, Rev. Thomson died of sunstroke, and the Rev. Penrose, of the Church Missionary Society, while on the way to the Tanganyika, was attacked by native robbers in Ugogo and slain, with sixty-three followers. Since then the Rev. Mullins has left England in order to reorganize the Tanganyika station and then penetrate from the south end of the lake to Lake Nyassa. At the same time some French Catholic missionaries, from Algiers, have left Zanzibar for the interior in order to establish stations on the banks of the Tanganyika and the Victoria Nyanza.

The Nile and upper lake regions have also been chosen as fields of action by

several missionary and exploring expeditions. The Rev. Wilson is still at Rubaga, King Mtesa's capital of Uganda on the Victoria Nyanza. In last August he traveled along the west and south lake shores to Kagahig--Stanley's old camp—where he met Mackay, who had come on from Zanzibar through Unyanyembe. The little missionary steamer, Daisy, is now afloat on the waters of the Victoria Lake. The other three members of the Church Missionary Expedition have by, last accounts, reached Bigaf on their way to Uganda by way of the Nile. This place is above Gondokoro, and near the cataracts. The extraordinary height of the river was the cause of their long detention, but they have probably reached Mtesa's early this year. Dr. Schnitzler, who is called by the Turks Emin Bey, has also arrived at Uganda, where he met Mr. Wilson, and Dr. Junker is now making extensive explorations in the region of the White Nile and its numerous tributaries. Gordon Pacha and Gessi are still busy putting down the slave traders in those countries. Dr. Schweinfurth continues his explorations of the Arabian Desert and has now turned to the Fayoum for botanical and geological work.

The Italian Expedition.—The Italian Expedition to Southern Abyssinia has not yet succeeded in advancing far. Dr. Mattenci, after having been turned back once, has again arrived at Massowa, on the Red Sea. In March last Captain Martini and Signor Antonelli, a nephew of the late Cardinal, left Leghorn to go to Shoa with a great number of presents for King Menelek. They have arrived at Zeila, where they met the King's caravan, which is to take them and their goods to the capital. They will then push on to the south to join the Marquis Antinori, who is already reported at Kappa. The previous news of his death has been officially contradicted. Meanwhile, Cecchi and a companion have been taken prisoners by the Gallas, and the King of Shoa has sent out an army to rescue them.

The West Coast.—The same German African Society which has equipped Rohlf has sent forth several others of its explorers on this side of the Continent. Dr. Buchner, who sailed from Hamburg, October 19th, for San Paul de Loanda, left the coast in December, and went up the Kwanza River to Malange, which he reached January 28th. He is now at Cassange, still further west, near the Kwango, and is waiting for the end of the rainy season in May, before going on to Mussumba, the new capital of the great Mwata Yanvo, for whom he is taking presents from the German Emperor. If possible, he will then follow the Upper Lualaba down to Nyangwe. Engineer Schuette, who is sent out by the same Society, arrived at Loanda December 10. While exploring the course of the Upper Kwanza he was robbed of all his goods by the Bangala, near the Rio Lui, on August 17th, but succeeded in crossing the Kwango, and has now gone northeast from Kimbemdu, in order to penetrate into the Adjellengo country. Major Mechow, a third member of this German expedition, will attempt to descend the Kwango River from Cassange till it joins the Congo, where Stanley heard it called the Ibari Nkutu.

FRENCH EXPLORERS.—The French explorers have also executed some important work on the west coast, taking their Senegal and Gaboon colonies as starting points. Lieutenant de Brazza has returned to Paris from his successful expedition to the sources of the Ogowai, but he intends to start again soon for Africa, in order to follow down the Alima or some other of the eastward streams discovered by him, and return by way of the Congo. Paul Soleillet has not succeeded in his attempt to reach Timbuctoo and then cross the Sahara to Algiers. He left the French settlement of St. Louis, on the Senegal, April 17th, and reached Segu, on the Upper Niger, on October 1st. He stayed there three months but was prevented by the Sultan from descending the river to Timbuctoo. He has recently returned to Paris but intends to make another attempt to reach his goal by way of the northerly oasis of Tishit. Count de Semelie left Bordeaux in April last, and in May went up the Niger and then ascended the Binnie, its right branch, as far as Okeri; he returned to Fernando Po February 13. Lieutenant Marche, who has already made an expedition up the Ogowai, left Paris recently, in order to continue the exploration of the still unknown Brinne sources and the country between the Shari and the Congo. The French Geographical Society has just appointed a committee for African explorations, which has decided to send out three expeditions. They will start simultaneously from Algiers, the Senegal and the Niger, and are to meet at Timbuctoo.

COMMODORE SHUFELDT.—The Lower Congo will also be further explored, while Commodore Shufeldt will go up the river in the United States Steamer Ticonderoga as far as the first falls. The Baptist Missionary Society will soon launch a small steamer above the Livingstone Cataracts, with which the Rev. Comber intends to ascend and explore the mighty stream which Stanley was the first to reveal to the world. Major De Serpa Pinto has just crossed Africa from west to east in 300 days. The foregoing summary of all exploring expeditions at present engaged in penetrating into the interior of Africa shows how much energy is now being employed to open up the "Dark Continent." We may therefore look forward to the early attainment of some very important successes in African exploration.

AUSTRALIA.—In Australia, Sergison's expedition in the northern territory and Forest's in the western are to be noted though one from Queensland westward does not seem to have made much headway. D'Albertis, in his two recent papers read in London, has given the chief results of his long and thoroughly scientific exploration of New Guinea. The gold discoveries in the island by Mr. Goldie have caused much stir in Australia, though the straggling bands of adventurers that have gone to collect it have not done either themselves or the natives much good. Mr. Goldie has added a little to our knowledge of the interior and the southwest coast. The narrative of the French explorer Raffray of his visit to the north of the island was given this year to the Paris Geographical Society; his

study was mainly of the people. We recently gave the results of Miclucho-Maclay's visit to the Pelew Islands. Dr. O. Fusch, of the Berlin museum, has recently started on a journey of exploration to Southeast Asia and Astralia; from so qualified an observer the best results may be expected.

SERPA PINTO'S WHITE AFRICANS.

Among the many interesting particulars of discovery brought from Africa by the gallant Portugese explorer, Major Serpa Pinto, none is more absorbing than his story of the white people encountered between the rivers Cubango and Cuando. Senhor Pinto found in these districts a tribe absolutely European in tint, yet nowise of the Albino type, for their hair was black and woolly. He describes them as uglier than the plainest negroes, and lower in civilization than any race met with. Two of the tribe he captured, and, having tamed them by kindness, induced them to take him to a village of these pale-faced Cassaqueres, where the explorer passed two days. They wander over the country, living upon the chase. Having receding foreheads, slanting eyes like the Chinese, prominent cheek bones and hanging lower lips, their general appearance fails to do much credit to the white man, whom they resemble. In hunting they are marvelously skillful, and can bury one of their reed-arrows in the body of the elephant up to the middle of its shaft. The traveler saw a girl among them fairer than himself, and those who have the pleasure of Major Pinto's acquaintance will be aware that he is by no means a dark man for a Portuguese. Who, then, and whence are these people so strangely recalling the tribe spoken of by Mr. Stanley between the Equatorial Lakes? The African whites, the Anthropophagi and the Dwarfs have now all been found, and it only remains to discover the people with tails, the peculiar tribe that shade themselves from the heat with their enormous feet, and those remarkable beings who "eat their parents and curse the sun," to have completely verified the wildest stories of Herodotus.

A LETTER FROM NORDENSKJOLD.

We are enabled to lay before our readers the following extract from the famous arctic explorer's last letter to his family. The letter is dated: "On board the Vega, icebound on the north coast of Siberia, just east Koljuschin Bay, latitude 67 deg. 7 min. longitude 173 deg. 15 min. west of Greenwich, the 16th of October, 1878 —Since I last wrote from the mouth of the Lena River the Vega has pressed forward, though with no little difficulty, to the vicinity of Behring Strait—*i. e.*, to the part of the Polar Sea which is every year visited by whalers from the Pacific Ocean and trading vessels belonging to the American Alaska Company. These vessels have frequently left these waters as late as the middle of October. As a result from the northern and northwesterly winds blow-

ing in these regions during the whole of September, it appears however, that this year a most unfavorable condition of the ice has prevailed in the Polar Sea, near Behring's Strait. The ice-free channel which in the proximity of the coast facilitated our progress as far as beyond the mouth of the Lena River, ended at the Basanow Islands, which we passed on the 3d of September. Since then we have gone through dense masses of floating ice so slowly that we did not reach the eastern coa-t of Koljuschin Bay until the 27th of September.

"The night of the 20th the ocean was covered between the glacial fragments with new formed ice, so that we were forced to abandon further attempts to proceed, but temporarily lay to alongside some large floes of solid ice about half a mile from the beach. Three days later we were able to walk ashore on the new formed ice. Consequently everything is as satisfactory as possible, in the event of our being obliged to spend the winter here. The coast is inhabited by Tschutsches, with whom we are in communication on most friendly terms, although as these natives do not understand or speak Russian, we have some difficulty in making ourselves mutually intelligible. Lieutenant Nordgvist, however has made a good beginning in learning their language. They declare unanimously that the ice will again break up ; but in the event their prediction should fail I send this letter by a Tschutsch chief, who happened to visit the village near our place of anchorage. It is most uncertain whether we will succeed in making him understand the meaning of the papers we hand him, and it is doubtful whether they will ever reach their destination. All hands are well, the vessel in perfect condition and the supplies of coal and provisions abundant. The Tschutsch chief, who has appointed me to be the *Ispravnik* in Ochotsk, was pulled to the vessel, when he paid us his state visit, in a sleigh drawn by two of his dwarfed subjects."

THE SIBERIAN TSHUDI.

A letter from one of Prof. Nordenskjold's assistants, recently published in various Scandinavian papers, gives an interesting account of the Tshudi, a peculiar race inhabiting the northeastern part of Siberia. They look very much like the Greenlanders; are small but alert, have a brownish-yellow skin, with coal black eyes and hair, and a singular joyless, almost frozen expression of face. They live in tents, dress in skins, and feed on seal-flesh. Their women are tattooed in the face. In their intercourse with the crew of the *Vega*, they were a little shy, but curious like penguins, and willing to help. Their moral ideas were rather *naif* but firmly adhered to, as far as they went. Of their language a dictionary (Tshudi-Swedish) has been made, comprising about three hundred words, and it will, no doubt, prove of interest to the linguists, as the tongues of the Polar races have hitherto been as great a puzzle to philologists as those of the negroes of tropical Africa.

NEWS FROM THE JEANNETTE.

The Arctic steamer Jeannette was at Port Illuluck, Ounalaska Island, on the second day of August. After taking on board a supply of fresh water and provisions she was to sail north on the fifth. Her route from Ounalaska harbor, which is on the north side of the island, 2,100 miles from San Francisco, will be as follows: She will pass through Unalga Pass from the Pacific Ocean into Behring's Sea. The prevailing winds are usually westerly, but after reaching about 50° north latitude, calms and fogs prevail. From Ounalaska, after having coaled ship, she will proceed to St. Paul's Island, two hundred and forty miles distant. At St. Paul's is a trading post of the Alaska Commercial Company, and there she will receive a supply of sealskin clothing for the crew, presented by the Alaska Company. From thence she will sail for St. Michael's, near the mouth of Yukon river, a distance of five hundred miles from St. Paul's, where dogs, sledges, snow shoes, fur clothing and a few natives will be taken on board. From St. Michael's she will proceed to St. Lawrence Bay, on the coast of Asia, a distance of two hundred and thirty miles, for the purpose of obtaining news of Prof. Nordenksjold's expedition, as well as to procure additional fur clothing and supplies. From St. Lawrence Bay the Jeannette will pass directly through Behring's Strait into the Arctic Ocean, shaping her course along the shore of Wrangel's or Killett's Land.

THE GEOGRAPHICAL SOCIETIES' ANNUAL.

Messrs. Paul Dreyfus and Armand Lucy propose to undertake the publication of a 'General Year Book of Geographical Societies." The work is to contain each year the regulations of each society, a list of its members and an analytical *resume* of its work during the preceding session.

In the case of foreign societies, however, on account of space, they will publish full lists of members only in cases of special agreement, confining themselves otherwise to the names of the persons who compose the governing bodies. The general body of the work will be preceded by a brief account of such occurrences during the previous year as are of interest to geographers, together with biographical and obituary notices

The editors request that all communications on the subject of this work may be addressed to M. Armand Lucy, No 10, Cité Trévise, Paris.

The Royal Geographical Society of Great Britain encourages the study of geography in the public schools by the annual award of gold and silver medals to the four pupils who pass the best examination upon the especial subject selected by the society. At the last annual meeting it was stated that out of fifty-three large schools which were invited to send candidates at the last examination, sixteen had done so. The subject selected for next year's examination was "Western Africa," between the Sahara, the territory of Egypt, the Equatorial Lakes and the 6th parallel of south latitude, which just takes in the mouth of the Congo river.

PHYSICS.

THE MAGNETIC SURVEY OF MISSOURI.

Last summer Professor Francis E. Nipher, of Washington University, St. Louis, and Mr. J. W. Shaüb, his assistant and a student of the University, spent several days in this city taking magnetic observations. The high bluff on Seventh street, between Walnut and McGee, was selected as the most eligible location in the city to make the necessary observations. The determinations made are:

1. The declination, or "variation," of the magnetic needle.

For this purpose, the true meridian is determined by observations on the sun or the pole star.

For determining the magnetic meridian, observations are made on a magnetic needle, by means of a transit instrument. The needle is of unusual form, and consists of a hollow steel cylinder, suspended by a fiber of unspun silk. In one end of this hollow magnet is a scale with 160 divisions, each representing two minutes of arc. This scale is in the principal focus of a lens, which is fixed in the other end of the magnet. Through this lens the magnet scale is observed by the telescope of the transit, which magnifies sufficiently so that one-tenth of a scale division, or one-fifth of a minute, can be read.

The angle between the true meridian and the magnetic meridian is the variation sought. For Kansas City, this variation is 10° 7′ east. This angle is decreasing at the rate of about three minutes per year. In the Eastern States the needle points west of north, while near Cleveland, Ohio, there runs a line of no variation.

2. The "dip" of the needle is also obtained. This is done by means of an eight-inch needle, which is exactly balanced on agate supports, so that it can move in a vertical plane. When the plane of the needle—and the circle in which it plays—is in the magnetic meridian, the north pole of the needle is found to dip downward, in the northern hemisphere, while the south pole dips downward in the southern hemisphere. The dip increases to the north, and becomes 90° (that is, the needle stands vertically) at the magnetic pole. At Kansas City the dip is 69° 10′; at Iowa City it is 72° 2′, while at Vinita, Indian Territory, it is 66° 40′.

3. The *intensity* of magnetism is obtained by oscillating the same magnet at different places, the time of oscillation being determined to the one-thousandth of a second. The strength of this magnet remaining the same, the magnetic force of the earth (horizontal component) varies inversely as the square of the time of oscillation. The magnet, however, gradually loses its strength, and it is therefore necessary to make a correction for this. This is done by the so-called method

of deflections, but the manner of doing this is somewhat difficult of explanation to non-mathematical readers, and hence may be omitted. The magnet used by Prof. Nipher has been in use for over twenty years in the coast survey, and changes very little now.

It is also necessary to correct all the observations for the torsion of the delicate silk fiber on which the magnet hangs, and for the varying temperature. An increase of temperature causes the magnet to move more slowly, for two reasons: 1st, the magnet itself is weaker; 2d, by expansion, it becomes slightly longer. These corrections are, of course, small; but it is necessary that they be made.

Prof. Nipher spent the summer vacation last year in making a magnetic survey of the state of Missouri, and in some instances he took observations outside the State, and even went as far south as Vinita, Indian Territory. When the summer session of the University closed last June, he went to work again for the purpose of testing some of the observations made last year, and to take additional ones this year. The first observations he took this year were at Des Moines, Iowa, where he ascertained the exact variation of the magnetic needle. Then he came back to Missouri and went to work again. On arriving here he went to the same location that he occupied last year in this city, and, with the assistance of Mr. Shaub, took observations the greater portion of the day, which verified in a remarkable degree those taken last year.

Part of the instruments used in the survey are loaned by the Coast Survey, the others having been constructed in the work-shop of Washington University. The means necessary for carrying on the work have been in part given by public spirited citizens of St. Louis, the deficit being made up by Prof. Nipher.

But of what use is this magnetic survey? So far as a direct pecuniary advantage to the state is concerned, it is worth but little. It does not propose to change any boundary lines that have been established by the general government; neither is it intended to throw Kansas City west of the boundary line between Missouri and Kansas, nor to unsettle dividing lines between neighbors. Nothing of this sort is intended. Prof. Nipher is willing to undertake the work simply as a contribution to science. It is, however, important that the distribution of the earth's magnetism be accurately known, as this renders the use of the mariner's compass safer. These values have never been accurately determined for the interior of our continent, and hence the Missouri observations will fill a gap in our knowledge of this subject.

Prof. Nipher assures us that these determinations will probably bring out some new points in relation to local distribution of magnetism, the nature of which he declines as yet to make public.

William Leroy Broun describes a new lecture experiment, to show the action of terrestrial magnetism. A rectangular frame of light wood, carrying twenty coils of insulated wire, was suspended in a horizontal position from the pans of a balance, so that the long sides of the rectangle were at right angles to the

beam; and mercury connections were arranged at the middle of the short sides, so that a current could be sent through the wire. This apparatus being placed with the long sides of the rectangle perpendicular to the magnetic meridian, when the battery current passed from east to west on the northern side, and from west to east on the southern side, the north side would be attracted, and the south side repelled by the earth currents, both influences combining to deflect the beam of the balance. On reversing the current the deflection was in the opposite direction (*Nature*, vol. xvii., p. 281).

MINING INDUSTRY.

THE GEORGIA GOLD BELT.

BY ERNEST INGERSOLL.

The "gold belt," of which the most productive portion lies at this point, consists of a strip of land running somewhat irregularly nearly due northeast and southwest across the northern end of the state. It averages about ten miles in width, and has been traced 200 miles in length, parallel with the Blue Ridge. White, Lumpkin, and Habersham counties embrace the richest deposits, so far as now known, but the limits of mining are gradually widening. The presence of gold here has been known from the earliest times. Cherokee Indians were the occupants of the territory when white settlement first began, and they were accustomed to seek the gold for ornamental purposes, and to dispose of it in barter to less fortunate tribes. Evidences of their mining still remain, but are insignificant. The methods adopted by the first white settlers, and in vogue until recent years, were very rude, consisting merely of washing out the gravel of the beds of the streams by running it through sluice-boxes and splint baskets into a "gum rocker," which was nothing but a split and hollowed out log a dozen or so feet in length. * * * * * * * * *

It is said that the first piece of gold ever taken in the United States belonged to this deposit, and was picked up in 1799 by Conrad Reed, a boy who lived in Cabarrus county, North Carolina. It was as large as a smoothing-iron, but was sold to a silversmith for $3.50. Afterward much larger lumps were found; one weighed twenty-eight pounds, according to tradition. This excited so much attention that exploration was begun, and the gold traced southward until the borders of the Cherokee territory in northern Georgia were reached, and prospectors began to encroach upon the reservation. Protests from the Indians naturally followed, and Georgia sent a large police force to keep back the invaders, but it was of little avail. The rush to the mines was much like the stampede to the Pacific coast in 1849. * * * * * * *

Finding that no protection of the Indians by police measures was feasible, the state, in 1830, adopted the Indians, territory and all, and constituted the region a county, called Cherokee, out of which several small counties have since been made. Then the mineral lands were divided up into forty-acre lots, and put up at a lottery by the state. One of these lots, on the Yahoola river—No. 1052—now a part of the Hand Company's property, had already become celebrated. It was within the reservation, but men used to creep across to it at night, and carry home a meal-bag full of dirt, out of which they would pan from twenty to forty dollars next day. The instant it was ascertained that an old farmer down in the central part of the state had drawn this prize, shrewd speculators set off post-haste to buy it from him. * * * * * * *

It soon came to be found here, as elsewhere, that gold was not to be picked up in twenty-eight pound lumps every day, nor did every bushel of soil pan out a double-eagle. At present the mines are largely owned by corporations, or by private capitalists who are not residents of the district. Only two of the companies, however, are represented in the New York Mining Board, if I am rightly informed. It was found that as the gold occurred neither in extensive placers, like those of California, nor in indestructible quartz lodes, the methods of mining in vogue elsewhere would not answer here if the best results were to be obtained. But the utilization of water, and the practical methods by which the enormous power of this natural agent has been put under the miner's control, are the work of Colonel Hand, to whom, more than to any one else, no doubt, belongs the credit of the splendid development of this industry during late years, and the glowing prospects it now holds out.—*Harper's Magazine for September.*

WEALTH OF THE SAN JUAN REGION OF COLORADO.

LIEUT. C. A. H. M'CAULEY, U. S. A.

We cull from the official report of an extensive and thorough reconnoissance of the San Juan Region, in the fall of 1877, by Lieutenant McCauley to the Chief of Engineers, the following items, which will doubtless be of interest and value to many persons already owning property there, and to others who incline to invest but lack confidence. Of course many important changes and advances have taken place in some localities since this report was made, but the main facts as to minerals, geological formation, topography, &c., remain the same and can be relied upon as conclusive.—*Ed.*

"The San Juan is locally subdivided into mining districts. In speaking, therefore, of mineral wealth as it appeared to an ordinary observer, it will be best to consider each district visited in its practical development.

The precious metal is mined in the form of both silver and gold, the former predominating. Of the latter the value of the placers is inconsiderable, and upon lodes alone should any dependence be placed.

In arriving at the value of a mineral deposit, from a casual examination of specimens of its ore, the most learned geologist, the most experienced assayer may be at fault. Nothing short of a complete assay will give its definite and precise value and worth.

The extension of this rule is equally true. The value of a mine can never be wholly determined by any specimen. The market price of the ore in general must alone be taken. In brief, the "mill-runs," or prices paid at the smelting-mill or other reduction-works, is the sole standard upon which dependence is to be placed.

In giving the ton-value of the ore it is frequently placed in ounces. This is, correctly speaking, the proper mode, though not always the popular one. At the time of the examination of the mines the value of the standard silver ounce was $1.20. An increment of one-fifth to the ounce per ton will therefore represent the money value when otherwise denominated.

The Summit District is some 27 miles southwest of Del Norte, reached from the latter point by a fine toll-road, and lies mainly upon the slopes of South Mountain, a divide between the waters of the North and South Forks of the Alamosa.

This is a most remarkable gold district. It may be said to consist chiefly of a single mine; for, while the mountain is covered with stakes, there being in all 2,300 locations upon it, one of them is of immense value, some half a dozen are worth having, and the whole of the rest are not worth $5 at present.

No well-defined veins or lodes have as yet been found, as, in true fissure formation, the mineral-bearing rock, consisting of "rotten" or decomposed quartz carrying free gold, the metal being free from impurities and more easily milled than any other gold ore in Colorado.

The principal mine of the district is the Little Annie, other prominent lodes being the Golden Queen, Major, Yellow Jacket, Ida, Golden Star, Summit, and Odin.

The Little Annie having proven very valuable, it was surrounded upon every side with locations, but up to the present time none of these have given positive indications of deposits of the same character and value.

Assays of Little Annie ore have varied from a small amount to many thousands of dollars. The average mill-runs have been $102 per ton, the best ore being $150, tailings $48, the cost of mining and milling being $12, leaving a large profit to the stock-holders or foot-holders of the mine. The lode was 85 feet below the surface, the pay streak, so called, being from 20 to 25 feet wide. This is remarkable as being the highest mine in the world, lying at the edge of timber-line and not far below 12,000 feet, the reduction-works in the gulch at the base of the hill being about 11,200 feet above the sea. This was one of the best paying and most economically managed property found in the San Juan, and can scarcely be surpassed in the whole of Colorado. At the time of the first visit (June 30, 1877) there had been taken to date from the opening of the mill, as we were informed by Mr C. E. Robbins, the treasurer and chemist of the company,

$105,000, of which $47,000 had been paid out in dividends, the balance being expended in the plant, including a 10-stamp mill, and items of current expenses. A tramway of over 2,000 feet in length conveys the ore from the dump-pile at the mine to the works below.

The Animas District is situated in the San Juan county and along the river whose name it bears. Half a mile above the mouth of Cunningham Gulch, opening into the Animas river, is the dividing line, we were informed, between this and Eureka district, which lies to its north. It includes mainly, therefore, the mines in the gulches and creeks, reaching the Animas and Baker's Park and those upon the overlooking mountains, chiefly along Cement and Mineral creeks, Arastra, Boulder and Cunningham Gulches, and upon Sultan, Anvil, Green, Hazleton, Galena and King Solomon Mountains. It is the oldest mining district of the San Juan, containing the Little Giant, whose early discovery resulted in the great immigration to the country. It includes some of the most valuable mines in the valley of the river, and within its limits a larger number of lodes of a high quality of ore have been located, and in part are being worked, than in any other district of the San Juan.

The ores of this section are argentiferous, with the exception of those of the Little Giant and a few other exceptional ones, which have been found to contain gold; in general, therefore, they may be said to be of argentiferous galena, with and without gray copper, occasionally chloride of silver, and in several mines the black sulphurets being found.

The number of lodes that contain first class ore is very large, and as there are over 2,000 lodes registered in the county offices at Silverton, and the prospects of all are, in general, very good, the work involved in an examination of this district may be imagined, the mountains being everywhere covered with apparently an inexhaustible quantity of lodes.

The most prominent mines are the Little Giant (gold), (now called the Golden Giant); Highland Mary, Pride of the West, Philadelphia, Susquehanna, Pelican, Aspen, Green Mountain, Legal Tender, Victor, Little Fanny, North Star, Letter G, Molly Darling, Pelican, Bull of the Woods, Comstock, Silver Cord, and King Hiram Abiff (gold).

Viewed financially, this section labors under more difficulties than any other of the San Juan. With large bodies of valuable mineral within it, tho lack of capital and reduction-works keeps them undeveloped. At no place is there so fine an opening for a banking firm. There exists none in the town, and with the activity of trade the scarcity of currency is severely felt; local checks of various kinds, the shinplasters of war times, and drafts on distant banks being had recourse to.

In the entire San Juan the discoverer of a vein or lode is allowed a surface area of 1 500 feet along the vein, 150 upon each side of the vein and perpendicular thereto. The planting of a stake containing the location notice and the designation of its boundaries holds the "mine" for the period of sixty days, by

the end of which time a 10-foot shaft must be sunk, or a vertical exposure of 10 feet of the vein be made, to prevent its being "jumped," or taken by the first comer. Within a month or ninety days from the date of the discovery stake, the location certificate must be filed in the office of the county recorder. The amount of work necessary upon a lode to file this certificate is generally known as the first assessment, a certain amount in accordance with the requirements of national statutes being annually required to prevent forfeiture. It therefore follows that while a large number of locations may be indicative of promising mineral deposits, that fact alone does not decide the wealth of the district. Without thorough development the richest vein is as valueless as the most worthless prospect holes.

From an outline sketch, herewith accompanying, (Fig. 4 of Cunningham Gulch, Plate 6,) an idea may be formed of the deeply eroded character of Cunningham Gulch, and the location of the mining properties at its upper end.

Within the Animas section, as may be inferred, are situated a larger number of first class and high-grade silver mines than are found in any other district of the San Juan The lack of reduction facilities and good roads has been its drawback.

The supplies of material reaching Silverton are mainly brought by trains of burros, which are valued here at $25 to $30 each. Freight by burro-trains from Silverton to Antelope Springs is two cents per pound; for return freight three cents is charged. These trains are in charge of a driver, receiving from $60 to $75 per month; the pack transportation being 150 pounds for a burro, and from 200 to 250 for a mule.

The Eureka District, adjoining the Animas upon the north, is small in extent, but rich in lodes, and lies along the Animas river, from the dividing line near Howardsville to the divide between the Animas and Uncomphagre rivers. The most valuable mining properties are found in Eureka, Maggie, and Minnie Gulches.

The towns of the district are Eureka, at the mouth of that gulch and about nine miles from Silverton, and Animas Forks, located at the junction of the two upper branches of the river, four miles farther up; both of these, however, should be properly known as mining camps.

The principal lodes are the Tidal Wave, McKinnie, Crispin, Sunnyside, Yellow Jacket, Golden Fleece, Venus, Emma Dean, American, North Pole, Jackson, Grand Central, Big Giant, Little Abbie, Belcher, Chieftain, Boomerang, Silver Wing, Lily, Golden Eagle and Great Eastern.

The ores are in general argentiferous galena of high grade, gray copper accompanying; in Burns' Gulch specimens of the Lily and Golden Eagle lodes contained brittle silver in considerable quantities, while in Eureka arsenical ores are found. On Jones' Mountain, not far from this gulch, the Silver Wing, one of the finest mines of the district, contains seven lodes so situated that they will be readily worked by a single tunnel. The owners propose erecting here, during the season of 1878, smelting-works for their own use.

The Park District so named from its containing Burrows Park, a mountain valley between 10,000 and 11,000 feet in height, adjoins the Eureka on the east. Through this district a road from Animas Forks, via Cinnamon Gulch, passes down the Lake Fork of the Gunnison to Lake City, about 29 miles distant. This road, however, is in such wretched order that all teams for Lake go from Animas Forks, via the Hensen Creek toll-road, which is in fine order, besides being six miles shorter.

The Park District lies mainly in Hillsdale county, and within it are situated some fine properties which are being rapidly developed.

The principal mining points are Sherman, on the Lake Fork, at the mouth of Cottonwood creek; Argentine, about six miles farther up the stream; Tellurium, at the head of Burrows Park, and the American Basin, a huge depression, about two and one-half miles long and one wide, immediately to the west of Handie's Peak. Several gulches entering the park, also contain some valuable lodes, the most important of which is the Cleveland, coming from the northwest nearly, and below Tellurium.

Among the most promising and best developed lodes are the Hidden Treasure. Major, Vulcan, Mountain Curve, Garden City, Cuba, Little Edith, Lily, Inez, Cashier, Silver Queen and Del Norte.

The nature of the ores is wholly silver, no gold having as yet been found; they are generally a fine grade galena, with and without gray copper; a few of them carry diocrastie or antimonial silver, and one or two, indications of pyragyrite or ruby silver.

Their value is that of first-class ores in general, some few running to quite a low grade, but in large quantities. The Hidden Treasure, of the American Basin, gave an assay while we were at Lake of 3,287 ounces; some ore of the Major has sold for a dollar a pound.

The Uncomphagre District lies on the north of the Animas district, Cement creek being to the southeast, and the north fork of Mineral creek to the southwest of Read Peak or Mountain, while Red creek, of the Uncomphagre, runs down its northern slopes; it lies also northwest of Eureka district, Mineral City and Poughkeepsie Gulch, being in that direction from Animas Forks.

It lies, moreover, upon the Pacific slopes of the mountains, its mines being in the gulches of Poughkeepsie, Red, Bear and Cañon creeks, which dash down in most horrible and frightful canons, eroded from the massive mountains circling their heads, their bottoms choked with *debris*, and very often inaccessible. Words are inadequate to describe the appearance of these canons from above. Each looks like a perfect wreck of matter, or an exploded world piled below in strange confusion; the fiercely red peaks about lending a brilliant contrast to the long stretches of timber and the valley far below and beyond. The wealth of mineral deposited here by nature was apparently proportioned to its inaccessibility. Mines are most numerous in the Animas; capital has aided them at Lake most largely, but in the Uncomphagre Mountains nature made them richest.

Mineral City is its town, nearest Eureka district, being on a fine toll-road, three miles over the range from Eureka, and about twenty miles from Lake City, by the Hensen creek road. It is an important mining camp, is at the edge of timber line some 11,500 feet above the sea and is claimed to be higher up in the heavens than any other town in the United States, if not the loftiest mining camp of any size in the world.

Way down the Gulch, on the Uncomphagre river less than six miles by air-line, only seven and one-half or eight by trail, but one hundred and twenty by the wagon-road via Lake City, lies Ouray, the largest town of the district and rival, perhaps, of Lake City and Silverton in the distant future.

A mineral belt apparently runs to the southwest from about Ouray, including the gulches to the south, and continuing on to Red Mountain, at the head of Cement creek and the north fork of Mineral creek. Mines that lie within its course partake, more or less, of its peculiar characteristics, which differ from the Animas and other ores in possessing less galena and more of the sulphurets than other sections. Being of a high grade and easily treated, they are great favorites at works for the general reduction of ore.

In the northern part of the district, close to Ouray, on the west edge of town, and at the mouth of Canon creek, is the Fisherman lode, wonderfully rich, containing native and brittle silver, assays being as high as $30,000. The Trout is an extension thereof, containing gray copper, while the Johnny Bull, close by, carries the same ore as the Fisherman, and is presumed to be one of its spurs. The Ophir, Watson, Three Brothers, Cedar and Clipper are also near by; the Sivyer and Union, on Bear creek, and many others, including the Mount Cline, Alaska, Saxon, Tyrol, Poughkeep ie, Silver Coin, Gipsy Queen, Little Minnie, Out Pat and Lincoln Boy.

THE SILVER MINES OF ARKANSAS.

A correspondent of the St. Louis *Globe Democrat*, writing from Litt'e Rock, describes the mining region of Montgomery County and its minerals as follows:

The district embraces townships 1 and 2 south, ranges 23, 24, 25 west, which includes a district of about 216 square miles.

The main water courses are the Wachita proper, and its south and north forks, besides a large number of small streams and rivulets. all more or less suitable for water power. The same tract of land is well timbered with yellow pine, white and black oak, ash, hickory, black walnut, gum, etc., well adapted for building and mining purposes.

The district forms a basin of small rolling hills, which are continuous throughout its entire length, and is surrounded by the Ozark Mountains on the north, the Mazerne Mountains on the south, the eastern spur of the Cassotal and Little Missouri Mountains on the west, and the Crystal Mountains on the east. These

mountains are of secondary and primary formation, containing hornblende, granite, slate and porphyry.

South of the Mazerne range is a younger formation of novaculate and limestone. The summits of the Crystal Mountains show ledges of metamorphic sandstone, underlaid by slate and sub-carboniferous limestone, which leads to the conclusion that this entire mineral belt is underlaid by sub-carboniferous limestone and porphyry.

The basin itself shows calcous shale and slate—the latter being generally exposed in the gulches and river banks—and is traversed by a belt of quartz veins which runs in an eastwardly and westwardly direction, and can be followed westwardly its entire length through the Cassotal range to the Indian Territory, thence through the Wichita Mountains, in the northwest part of Texas, striking the Rocky Mountains in New Mexico, the belt showing the same formation throughout its entire length, which has been conclusively proven by many of our most eminent geologists and mining engineers who have spent years of time and labor in determining this important fact, and who offer as an evidence of the correctness of this view the fact that the same minerals exist in the same character of quartz and spar throughout both entire districts.

The veins opened up to the present time have given evidence of walls and selonge, and are the quartz veins freely impregnated by gouche, which dip north, and have more or less strong overlap south, and have a general strike from 8° to 25° north of east.

The eminent geologists, Profs. Church and Phillips. during their stay in Silver City, made upward of thirty assays, with the most gratifying results, the quartz, with two exceptions, ranging from 200 to 600 ounces of silver to the ton, and this from specimens picked up indiscriminately from the surface, and in which not the slightest indication of ore was perceptible.

These gentlemen were astonished to find such results from quartz that made no showing whatever and was in no case taken from a greater depth than twenty feet, which was hardly sufficient to enable them to determine with any degree of accuracy the extent or value of the ores of greater depth, but gave it as their opinion that their greatest richness would be at a depth of one hundred and fifty feet.

Prof. Phillips, who was in Mexico in the months of September, October and November, examined a large number of old silver mines in Chihuahua and Durango, and who has been four months in Arkansas examining its silver resources, states that the two fields in their general geology are almost identical in character, and feels convinced that these high grade ores from the quartz veins of Montgomery County will run to wire and other forms of native silver at a depth of 100 to 200 feet, as similar surface ores were found in the same character of quartz encased in slates as were mined by the old Spaniards at Parral, Santa Barbara and Inde, in the State of Durango, and all of which veins carried more or less native silver at a depth not exceeding 100 feet from the surface.

BOOK NOTICES.

THE HUMAN SPECIES. By A. De Quatrefages. New York; D. Appleton & Co., 12 mo, pp 498: For sale by M. H. Dickinson, $2.00.

This is volume XXVII of the International Scientific Series, and in our opinion one of the very best of the whole. Nothing equal to it on the same subject has come under our observation, whether considered in a literary, scientific or philosophical sense. The style of the author is clear, his knowledge of the subject profound, his treatment of other writers fair and his argument logical and convincing. Passing over the entire range of anthropology, beginning with the Various Kingdoms of Nature, he gives concisely the several anthropological doctrines and those tending to show the Unity of the Human Species; then the different hypotheses in regard to the Origin of the Human Species, with his own conclusions; then the Antiquity of the Human Species; Original Location of Man; Peopling of the Globe; Formation of the Human Races; Fossil Human Races; Present Human Races, and closes with the Intellectual, Moral and Religious character of the Human Species.

In the treatment of all these branches of the subject, the same close familiarity with all the investigations, theories and hypotheses that have been made, is manifest, and the same spirit of candor, in examining and disposing of them, prevails that characterizes the opening chapter.

As a compendium of all anthropological knowledge, and a complete philosophical dissertation thereon, this book will meet the wants of multitudes of readers.

THE ANNUAL RECORD OF SCIENCE AND INDUSTRY, 1878. Edited by Spencer F. Baird. 8 vo, pp 715. Harper & Brothers, New York. For sale by H. H. Shepard, $2.00.

At no period of scientific progress has the absolute need of a reliable and judiciously arranged abstract been so apparent as at present, and the scientific men and students of the United States are to be congratulated that this work has fallen into so capable and willing hands as Prof. Baird and his associates. It is well known that in no other country has this kind of work been so faithfully done. Volumes of a similar character have been frequently published in other lands, but they have not reached the fullness and completeness of this, for the reason that competent men have not been willing to give their time to the work. In America, however, the most eminent men in their different departments and branches of science have freely devoted themselves to the task of compiling from an almost endless list of sources, all the important facts showing the world's progress in their respective specialties, and, as must necessarily have been the

case, their work commands the respect and praise of intelligent readers of all nations.

As heretofore, Prof. E. S. Holden edits the astronomical department; Profs. Abbe and Rockwood that of physics of the globe; Prof. Geo. F. Barker those of terrestrial physics and chemistry; Prof. E. S. Dana that of mineralogy; Prof. T. Sterry Hunt that of geology; Lieut. Commander F. M. Green those of geography and hydrography; Prof. Hamilton L. Smith that of microscopy; Prof. Otis T. Mason that of anthropology; Prof. A. S. Packard Jr. that of Zoology; Prof. Theodore Gill that of vertebrate zoology; Prof. W. G. Farlon that of Botany; Prof. W. O. Atwater that of agriculture and rural economy; Prof. W. H. Wahl that of engineering, technology and industrial statistics; Prof. Theo. Gill those of bibliography and necrology. The index is one of the most indispensable features of the work, being copious and accurate. No scientific library is complete without this book, and no editor, lecturer or student can spare it from his table.

FANTASMA, AND OTHER POEMS. Kansas City, Mo.: Ramsey, Millett & Hudson, 1879; 12mo, pp. 318.

This little work was laid upon our table by a well known and accomplished writer of this city, "with the compliments of the author," but whether he intended thereby to mislead us or not, a few moments' perusal of the leading poem satisfied us that a more delicate, though perhaps not a more skillful and tuneful hand, had struck the lyre in its harmonious lines.

In "Fantasma" the beauty of the story, and the purity of the thread of thought upon which its frequent pearls of poesy are strung, fully occupy the reader's mind and totally overshadow any possible shortcomings in versification for all readers except "professionals," who, from the very nature of their employment, lie in wait for defective iambics and trochees like cats for erring mice. The sentiments of the writer are exalted, which is the first requirement of true poetry, while the unfolding of spiritual truths, of which this work is a striking example in many portions, is justly regarded as the highest office of the poet. In these respects "Fantasma" may be regarded as a well rounded and admirably written poem. In other features of true poetry, such as imagination and rhythm, it is, as a whole, less successful, for, though there are many lofty flights, and most lines are perfect in their quantities, these characteristics are not uniformly sustained throughout. These are the views of a "professional," and will probably be regarded by most readers of this really meritorious poem as hypercritical; but we believe that they are just, and that they will be so regarded by the author by the time the work appears in a second edition.

The second poem, called "The Light Bringer," is more perfect in its versification than the first, but hardly equal to it in other particulars; and, in fact, this may be said of most of the subsequent and shorter pieces, though some of the latter contain gems of rare merit. Notably among them are "The Jewel Seeker,"

"Indian Summer," and "The Lily Queen," each of which discloses the genuine poetic taste and talent of the writer in frequent expressions of tender and exalted feeling and beautiful, life-like similes.

This is the fourth handsome book of poems published by Ramsey, Millett & Hudson within a year, which is an evidence of rapid æsthetic progress in the West, as well as that in business, science and agriculture, of which we boast so much.

THE DAWN OF HISTORY. Edited by C. F. Keary, M. A. Charles Scribner's Sons, New York; 12mo, pp. 240. For sale by M. H. Dickinson; $1.25.

This is intended as an introduction to pre-historic study, and seems to be the joint work of C. F., H. M., A., and H. Keary, the first named being the editor and connected with the British Museum. The numerous authorities consulted and the extent of ground covered in the preparation of the work show that it has been a labor of love and that no pains have been spared to give completeness to the world's knowledge of man so far as it could be done in so small a work. The main objects of the authors seem to have been to condense the general results of pre-historic inquiry to this date, and to indicate the methods of such inquiry when systematically and scientifically pursued. In these points they have been singularly successful, having put a vast amount of attractive and valuable information into the work.

To any one desiring an intelligent and readable abstract of the whole subject, with a complete list of authorities from every land, we know of no work so likely to answer the purpose.

SOME NEWSPAPER TENDENCIES. By Whitelaw Reid. New York, Henry Holt & Co.; 12mo, paper, pp. 76; 50c.

This is an address delivered before the editorial associations of New York and Ohio by the distinguished editor of the New York *Tribune*, in which he discusses the modern newspaper and its excellences and shortcomings. Having become satisfied that the price of the newspaper cannot be reduced because the people will not be satisfied with a less costly one, he proceeds to give his idea of what a newspaper should be; including better reporters, "brief summaries of the news for those who are hurried, supplemented by the most voluminous details for those who have special interest and ample leisure;" "better newspapers, the story better told, better brains employed in the telling;" and "greater judgment in selecting and genius in telling it." He concludes that the ability of the press is not declining, but insists that the papers of the country are better edited than they ever were before, their average courtesy greater, their average morality purer, and their adaptability to the wants of the whole closer.

It is an excellent essay; one which, if read generally by editors and newspaper readers, will have a good effect on both classes.

THE AMERICAN PLANT BOOK. By Harlan H. Ballard and S. Proctor Thayer. Size, 8¾ by 11¼; 64 leaves. Daniel Slote & Co., New York, 1879. For sale by M. H. Dickinson; $1.75.

The above named book—which is in reality scarcely a book at all, but simply a convenient sized herbarium in book form—is destined to receive a wide patronage among all people who love flowers and plants, whether botanists or amateurs, on account of its perfect adaptiveness, suitable shape and handsome appearance. It has been received with enthusiasm by grave professors, ardent collectors, and beauty-loving children, all of whom find it just what they want, in its different editions, of which there are four, ranging from one to five dollars in price, and from 56 leaves of about six inches square to 80 leaves of nearly twelve inches square. The specimens are to be attached by means of gummed strips (of which there is a full supply) to thick leaves of soft, porous paper, while between each two are printed blank forms for names, analyses, descriptions, etc. It really "supplies a long felt want."

FOOT-PRINTS OF VANISHED RACES IN THE MISSISSIPPI VALLEY. By A. J. Conant, A. M. 122 pp., large octavo. C. R. Barns, St. Louis, 1879.

Mr. Conant, who is only less well known as an archæologist than as an accomplished artist of St. Louis, contributed the chapters comprising this volume to a compendious volume known as "The Commonwealth of Missouri," published last year; but the general interest in archæology and the graceful style of the author created a demand for a reprint in a separate book, which has received the above title.

As we noticed the last named work in our August, 1878, issue, and copied freely from Professor Conant's article in our October issue of the same year, it is unnecessary again to express our high appreciation of it as a most valuable and interesting account of Western archæology, and especially of that of Missouri. Mr. Barns has brought it out in elegant style, and it will doubtless prove a complete success as a business venture.

OTHER PUBLICATIONS RECEIVED.—Proceedings of the American Association for the Advancement of Science, 1878; Chautauqua Assembly Herald, Chautauqua, N. Y.; Mind and Matter, Philadelphia, Pa.; Thirty-seventh Report of the University of Missouri; Organon of Science, by John Harrison Stinson, Eureka, Cal.; Report of the San Juan Reconnoissance, 1878, by Lieut. McCauley; Abstract of Colenso on the Pentateuch; Eighth Annual Report of the Kansas City Public Schools, 1878–9; the Tornado of April 14, 1879, by J. L. R. Wadsworth and Francis E. Nipher; Quarterly Report of the Kansas State Board of Agriculture, for the quarter ending June 30, 1879, by Alfred Gray, Secretary; the Necessity to Commerce of Cheap Water Communication between the West and the East; Catalogue of Elizabeth Aull Female Seminary, Lexington, Mo., 1878–9; Journal f Science, Toledo, Ohio.

SCIENTIFIC MISCELLANY.

THE NEW YORK AND BROOKLYN BRIDGE.

The bridge now in process of construction connecting the cities of New York and Brooklyn, will have the longest single span of any bridge in the world. The main span will be 1,595 feet 6 inches, and the land spans 930 feet each.

The bridge was designed in 1867 by John A. Rœbling, but he died in 1869, before any work on it had begun, and it has been built entirely under the guidance of Washington A. Rœbling, the present chief engineer.

The bridge extends from the junction of Sands and Fulton streets, in Brooklyn, to Chatham street, near the City Hall, in New York—a total length of 5,986 feet, the Brooklyn approach being 971 feet, the suspended part 5,445½ feet, and the New York approach, 1,502½ feet.

The approaches will consist of a series of brick and granite arches, which, when finished, will be ornaments to the two cities. It has taken nine years to complete the towers and anchorages, construct the cables, and get everything ready for the suspension of the floor.

Preparing the foundations for the tower was one of the most difficult parts of the work. Huge timber caissons, each 179 feet long, 102 feet wide, and 25 feet high, containing over 1,600,000 feet of timber, were sunk below the bed of the river until they rested on rock, or an equally firm stratum. On the Brooklyn side this was reached at a depth of 45 feet below high water; but it was necessary to go 78 feet below high water on the New York side. The pneumatic methods of sinking caissons is not new, but the operations here surpassed, by their immensity, everything of the kind that had been done before. The towers are 278 feet high. The anchorages are 129x119 feet at the base, 117x104 at the top, and 89 feet high.

The total amount of granite and limestone in the towers and anchorages is 142,000 cubic yards, and it required the continuous work for four years of over twenty quarries in Maine, Massachusetts, Rhode Island and New York to furnish the necessary supply. In the summer of 1876 the masonry was completed.

On the 29th of May, 1877, the first wire for the cable was stretched across the river. There are four cables, each consisting of nineteen strands, each strand containing two hundred and eighty galvanized cast steel wires, No. 8 gauge. These cables are 15¾ inches in diameter. For wrapping the cables, galvanized annealed iron wire was used. March 1, 1879, the four cables were completed—just twenty-one months after they were commenced.

The platform of the bridge, which is five feet wider than Broadway, is sustained by the iron cross-beams, and stiffened by six longitudinal trusses. It is divided into five parts, two outer parts intended for horse-cars and general vehi-

cle traffic, two intermediate divisions intended to accommodate the rapid transit passenger cars, and a central promenade, a little above the level of the main floor, and intended for pedestrians. The stiffening trusses will be iron, six in number, the two outer ones 9½ feet high, the other four sixteen feet in height. The total weight of the bridge will be 13,300 tons. It is proposed to move the cars on this bridge by means of wire ropes and stationary engines. This method is considered as preferable to that of locomotives, on account of the steep grade of the bridge.

It is estimated that the bridge, when completed, will have cost $13,500,000, of which $9,500,000 will be spent on the bridge itself, and $4,000,000 in acquiring the necessary real estate It is hoped that in 1881 the bridge will be opened to the public.

At a meeting of the trustees of the bridge, July 7th, the contract for supplying the steel and iron for the suspended superstructure was awarded to the Edgemoor Iron Company. The contract calls for 10,728,000 pounds of steel and 34,000 pounds of iron. The bid of the Edgemoor Iron Company was 4.35 cents per pound, amounting to $468,147. Chief Engineer Roebling said that when the change from iron to steel was first contemplated he supposed that the difference in price would be at least $100,000, but in fact the lowest bid for steel exceeded by only $4,000 the accepted bid for last year. The difference between the lowest bid and lowest bid for crucible steel was $365,000. Both towers of the bridge have been completed, the last work on the Brooklyn tower having been finished July 5th. Mr. Kingsley expressed the belief that through this contract it would be possible to complete the bridge by January 1, 1881. The financial condition of the bridge on June 30th was as follows: Total receipts, $10,623,492.94; total expenditures, $10,523,574 86; outstanding liabilities, $112,807.62.

UTILIZATION OF PHOSPHORUS.

Mr. Sidney G. Thomas, one of the inventors of the famous dephosphorizing process, not content with having rendered phosphorus—that dreaded impurity of iron and steel—harmless, has gone one step farther and proposes the utilization of the phosphorus which in his process is, as it were, concentrated in the slag. He roasts the cinder obtained in blowing pig with simultaneous additions of lime and oxide of iron, in a reverberatory furnace, in order to convert the protoxides of iron and manganese into insoluble peroxides. After calcination the slag is ground fine, and is treated with cold hydrochloric or sulphuric acid, diluted, or with a cold solution of sulphurous acid, which dissolves the phosphoric acid. With the latter solvent the phosphate will be almost at once precipitated on heating, while the sulphurous acid which is driven off may be recovered by condensation. The solution in hydrochloric or sulphuric acid may be completely evaporated, forming a concentrated product which, when the former acid has been

used, contains chloride of lime. These or any other methods practiced for the manufacture of phosphates may be made use of. As few have an idea of the enormous quantities of phosphorus which are annually wasted in the manufacture of iron, it may be interesting to cite the fact that the phosphorus contained in the iron produced in the Cleveland district of England alone amounts to 30,000 tons. Although the recovery of phosphorus is not a novel idea, it is possible that the concentration of phosphoric acid in the slag (7 to 15 per cent.) may render it practically attainable.—*Boston Journal of Commerce.*

LATE VIEWS OF THE AGE OF THE WORLD.

Geologists, astronomers and physicists alike have hitherto been baffled in their attempts to set up any satisfactory kind of chronometer which will approximately measure geological time, and thus give us some clue to the antiquity of our globe. It is therefore worth noting that Mr. Mellard Reade, of Liverpool, has lately contributed to the Royal Society a very suggestive paper, in which he endeavors to grapple with the question by employing the limestone rocks of the earth's crust as an index to geological time. Limestones have been in course of formation from the earliest known geological periods, but it would appear that the later found strata are more calcareous than the earlier, and that there has been a gradually progressive increase of calcareous matter. The very extensive deposition of carbonate of lime over wide areas of the ocean-bottom at the present day is sufficiently attested by the recent soundings of the Challenger. According to the author's estimate, the sedimentary crust of the earth is at least one mile in average actual thickness, of which probably one-tenth consists of calcareous matter. In seeking the origin of this calcareous matter, it is assumed that the primitive rocks of the original crust were of the nature of gigantic or basaltic rocks. By the disintegration of such rocks, calcareous and other sedimentary deposits have been formed. The amount of lime salts in water which drain districts made up of granites and basalts is found, by a comparison of analysis, to be on an average about 3.73 parts in 100,000 parts of water. It is further assumed that the excessed areas of igneous rocks, taking an average throughout all geological time, will bear to the exposures of sedimentary rocks a ratio of about one to nine. From these and other data, Mr. Reade concludes that the elimination of the calcareous matter now found in all the sedimentary strata must have occupied at least 600,000,000 of years. This, therefore, represents the minimum age of the world. The author infers that the formation of the Laurentian, Cambrian and Silurian strata must have occupied about 200,000,000 of years; the old red sandstone, the carboniferous, and the poikilitic systems, another 200,000,000; and all the other strata, the remaining 200,000,000. Mr. Reade is, therefore, led to believe that geological time has been enormously in excess of the limits urged by certain physicists; that it has been ample to allow for all the changes which, on the hypothesis of evolution, have occurred in the organic world.—*London (Eng.) Academy.*

THE FOURTH OF JULY UNDER THE MIDNIGHT SUN.

A party of Americans celebrated the 102d anniversary of our national independence at North Cape, Norway, latitude 71° 15′, longitude 25° 50′. They arrived there at 11 o'clock on the night of July 3d, and at one minute after midnight guns were fired and the shrill sounds of the engine's whistle were made to respond to the number of stars on our flag, and loud cheers given to usher in our great national holiday. The party then ascended the almost perpendicular cliff (900 feet high) and raised the American flag, the flag being made for the occasion by the ladies of the party out of materials purchased at one of the Norwegian towns. When the flag was raised cheers and guns again resounded over the waters. It was certainly a most extraordinary place for such a celebration—probably the first time that a party of Americans ever celebrated the 4th of July at such an hour and at such a latitude and longitude. The midnight sun shone upon them all the time with dazzling brightness. Far to the north they gazed out on the Atlantic ocean dashing against the great cliff on which they stood. Behind them were the snow-clad mountains, along which they had been coasting, and not a living creature was near them but the sea birds that arose screaming from the water as the silence of their home was broken. The North Cape is beyond seventy-one degrees of north latitude, and about one hundred miles north of Hammerfest, the most northerly town in the world. It is five degrees further north than the most northern part of Iceland.

They had a fine dinner on board, at which the noted Dr. J. Lawrence Smith presided. They drank toasts to "The day we celebrate," to "The President of the United States," to "The King and Queen of Norway," and to "Queen Victoria." This last toast was proposed in respect to several English ladies and gentlemen who most heartily participated in the celebration. Other toasts were drank, with the usual accompaniments of the occasion.

The following Americans participated in the celebration: Miss Augusta Caldwell, Dr. and Mrs. J. Lawrence Smith and James G. Caldwell, of Lexington, Kentucky; Dr. and Mrs. G. A. Lyons and Dr. Marcus P. Stephenson, of New Pork; Wm. C. Todd, of Massachusetts, and Dr. George Guier, of Delaware.

AN AUTOMATIC SAND BRAKE.

Mr. W. Wiseman, of the Indian Government Railway Department, is the inventor of a peculiar and original automatic sand brake for railways, which the *Engineer* describes and illustrates in a recent issue. On the axle of every wheel of the train is placed a cylinder, in which a circular plate, keyed to the axle and bearing a number of small blades, revolves whenever the train is in motion. The blade compartment surrounds a cylindrical compartment, which, being filled with sand, is called the sand box. The upper and the lower portions of this box are in communication with the blade box by a number of parts, of which the lower

can be opened and closed by means both of an electrical mechanism and automatically, while the upper ones, which are smaller, are always open. A plate, keyed to the axle, opens the lower sand ports with every revolution, but the sand thus escaping is so small in quantity that it is immediately swept back by the blades into the sand box through the upper ports. As soon, however, as the electrical circuit, which also controls this sand valve by means of an electro-magnet, is broken, the sand flows from the box very quickly, and, packing the blade box, stops the train. The same will occur when the train moves too rapidly or when one or more cars are left behind. It is, therefore, automatic, and its effect increases with the velocity of the train. Experiments made with a seven-horse-power engine were quite successful and promising.

Messrs. Torrey and Eaton, of the United States Assay Office in New York, made an assay, July 17th, of a piece of the meteorite which fell at Estherville, Emmet county, Iowa, on the 10th of last May. The specimen thus examined proved to be an "alloy of iron and nickel distributed in irregular masses through a matrix of rock," with a specific gravity of 5.5. The metallic parts, separated as far as practicable from all gangue matter, gave metallic iron 88.5 per cent; nickel, with trace of cobalt, 11 per cent. The gangue contained small crystals of zircon composed chiefly of zircon in granular form, intermixed with sulphides of iron and nickel, while carrying silica, alumina, lime and magnesia, but with no trace of the precious metals or copper.

THE AUDIOMETER.

After the last meeting of the Royal Society, Dr. Richardson demonstrated the action of a new instrument which he has named the audimeter, or audiometer, and which has just been invented by Professor Hughes, the discoverer of the microphone. The audiometer is used as a precise measurer of the sense of hearing. It is formed of a small battery of one or two Laclanche cells, a new microphonic key, two fixed primary coils, a graduated insulated bar, to which at each end one of the fixed coils is attached, a secondary induction coil, which moves along the graduated bar, and a telephone, the terminals of which are connected with the terminals of the induction coil. The principle of the audiometer is based on the physical fact that when the battery is in action and a current is passing through the two primary coils, the secondary coil on the bar becomes charged, by induction, whenever it is brought near to either of the primary coils; but when it is brought to the precise center between the primary coils there is a neutral point, or electrical balance, where the electric phenomena from induction cease to be manifested. By placing a microphonic key between the battery and one of the primary coils, and by attaching the terminals of the induction coil to the telephone, Professor Hughes was able to make the telephone produce sounds whenever he.

brought the induction coil near to one of the primary coils and moved the microphonic key so as to make it play on a fine needle suspended in the circuit. When the induction coil is close to one of the primary coils the noise is very loud, but as the coil is moved toward the center of the bar the noise diminishes, until it ceases at the center altogether. The scale on the bar is graduated into 200 degrees, representing units of sounds from 200 to 0, or zero. At 200 all who can hear at all can hear the vibration of the drum in the telephone. At 0 no one can hear, while between the two points there are 200 gradations of sound, from the highest down to zero. In using the instrument the telephone is put to the ear of the listener, while the operator moves the microphonic key, and at the same time shifts the induction coil on the graduated bar so as to measure the hearing power of the person under examination.—*London Lancet.*

THE HARVEST HYMN.

Once more the liberal year laughs out,
  O'er richer stores than gems of gold;
Once more with harvest song and shout
  Is nature's bloodless triumph told.

Our common mother rests and sings
  Like Ruth among her garnered sheaves;
Her lap is full of goodly things,
  Her brow is bright with autumn leaves.

Oh, favors old, yet ever new!
  Oh, blessings with the sunshine sent!
The bounty overruns our due,
  The fullness shames our discontent.

We shut our eyes, the flowers bloom on;
  We murmur, but the corn-ears fill;
We choose the shadow, but the sun
  That casts it shines behind us still.

God gives us with our rugged soil
  The power to make it Eden fair,
And richer fruits to crown our toil
  Than summer-wedded islands bear.

Who murmurs at his lot to-day?
  Who scorns his native fruit and bloom,
Or sighs for dainties far away.
  Beside the bounteous board of home?

Thank Heaven, instead, that Freedom's arm
  Can change a rocky soil to gold;
That brave and generous lives can warm
  A clime with northern ices cold.

And by these altars wreathed with flowers,
And fields, with fruits, awake again
Thanksgiving for the golden hours,
The early and the later rain. — *Whittier.*

The work of completing the jetties at the mouth of the Mississippi river was consummated a few weeks ago, when a uniform depth of thirty feet was obtained through the jetties, with a depth of twenty-six feet at the head of the pass. This virtually completed Mr. Eads' great work of opening the mouth of the Mississippi river. His contract with the Government only requires now that he shall maintain the present depth of water for the period of twenty years.

METEOROLOGY.

METEOROLOGICAL SUMMARY FOR JULY, 1879.

SIGNAL OFFICE, LEAVENWORTH, KANSAS, August 1, 1879.

There were few features in the weather of the past month to distinguish it from July of past years.

The mean pressure of the month was 29.871, which was but slightly below the July average. The highest barometer was 30.062, on the 5th; the lowest, 29.663, on the 11th.

The mean temperature of the month was 79.85°. The July average is 78.83°. The mean of July, 1878, was 80.30°. The highest temperature of the month was 97°, on the 11th; the lowest 61°, on the 30th. The highest July temperature ever observed at this station was 104°, in 1874. The greatest daily range of temperature of the past month was 25.5°, on the 8th; the least daily range, 7.5°, on the 1st.

The mean percentage of humidity for the month was 70.91 %, near 4 % above the average for July. The greatest daily mean was 86 %, on the 17th; least daily mean, 54.7 %, on the 10th and 11th.

The total rainfall for the month was 4.99 inches, about one-fourth of an inch below the average. The greatest July rainfall ever recorded at this station was 9.99 inches, in 1872; the least, 2.04 inches, in 1873.

The prevailing wind of the month was south. Total number of miles registered, 4,912. Highest velocity, 33 miles, from the northwest, at 9:25 p. m., 7th. During the month the wind was noted—blowing from the north, 30 times; northwest, 9 times; west 2 times; southwest, 10 times; south, 76 times; southeast, 40 times; east, 22 times; northeast, 19 times, and calm 9 times.

A lunar halo was observed at 2:40 a. m. of the 7th.

Six thunder storms passed over the station during the month.

Number of clear days during the month, 8; fair days, 15; cloudy days, 8, and days on which rain fell, 12.

YEAR.	Mean Barometer.	Mean Thermometer	Mean Humidity.	Total Rainfall.	Maximum Temperature.	Minimum Temperature.	Highest Barometer.	Lowest Barometer.
. . . .		deg's.	per c't.	inches.	deg's.	deg's.		
1872	29.972	78.43	——	9.99	94	62	——	——
1873	29.915	77.50	61.00	2.04	94	55	30.243	29.604
1874	29.886	82.80	59 50	3.23	104	62	30.097	29.502
1875	29.893	77.60	73.70	8.82	98	63	30.259	29.622
1876	29.893	78.90	69.70	4.01	95	54	30.111	29.642
1877	29.902	76.30	67.90	5.34	94	55	30.212	29.672
1878	29.876	80.30	70.50	3.08	100	61	30.121	29.519
1879	29.871	79.85	70.91	4.99	97	61	30.062	29.663
Average of 7 Years.	29.915	78.83	67.05	5.22	97	59	30.174	29.593

SAMUEL W. RHODE,
Sergeant Signal Corps, U. S. A.

MISSOURI WEATHER SERVICE, JULY, 1879.

BY F. E. NIPHER, WASHINGTON UNIVERSITY, ST. LOUIS, MO.

The temperature of this month has exceeded the normal at the Central Station 1.8°, and was 0.6° lower than that of July, 1878. In July, 1878, the mean temperature of the decades were as follows: 1st, 77.5°; 2d, 87.6°; 3d, 78.2°; mean, 81.6°. In 1879, the 1st was 83.4°; 2d, 81.5°; 3d, 78.3°; mean, 81°. The maximum temperature of July, 1879, exceeded that of 1878 1°. Engelmann has observed a temperature of 103.5° in this month.

The rainfall at the Central Station has been deficient 1.89 inches, and has been light throughout the State, except in the western and northwestern districts, the least precipitation occurring in the southwest.

The month is marked by a number of thunder storms, most of which were very local. Two, however, are well defined. The first entered our State from Kansas on the morning of the 17th. It passed Harrisonville and Lexington between 2 and 3 a. m.; at 3:30 a. m. it reached Boonville, passed Mexico and

Chamois at 4 a. m., and entered Illinois, passing Louisiana, Missouri, at 5:10 a. m. The second, a very violent thunder storm, entered the northwestern section of the State at Oregon, at 3:45 a. m. Its course was southeast until it reached Lexington, at 4 a. m., when it took an easterly direction, reaching Miami at 6 a. m., Glasgow at 6:18 a. m., Boonville at 6:35 a. m., Clark's Fork at 6:45 a. m., Dauphin at 8 a. m., Chamois at 9 a. m., Big Creek at 10:15 a. m., passing thence into Illinois. Several observers have neglected to note the exact time of *beginning* and *ending* of these two storms, and thus prevented my making this report as accurate and comprehensive as I would wish. Although these data of a rain storm are the easiest to obtain, they are very important and should never be overlooked or neglected.

The eastern district, although suffering for want of rain, has produced a fine wheat crop, and promises a large yield of corn. A large yield of corn is also expected in the southeastern section.

COLORADO WEATHER REPORT.

SUMMIT, COLORADO, August 20, 1879.

* * * * * * * * * *

Weather here cool and pleasant. Five hail storms and three light snows so far this month. Yours truly, C. E. ROBINS.

EDITORIAL NOTES.

JUST twenty-one years ago the first Atlantic cable was laid, and the first message dispatched and received. Great rejoicings were had, both in England and the United States, over the success of a previously regarded chimerical undertaking. But these rejoicings were of short duration. The line was not in operation quite two weeks before the cable parted, and for more than eight years—from September 1, 1858, to July 27, 1866, none of the numerous efforts to renew the connection between the two continents were successful.

PROFESSOR OTTO STRUVE, of the Pulkowa Observatory, Russia, is now in Washington inspecting the great 26-inch telescope of the Naval Observatory, with the intention of ordering a larger one if he finds that it excels his own 15-inch glass in power. Prof. Struve, who is one of the most distinguished astronomers in the world, will be present at the meeting of the American Association for the Advancement of Science, during its session at Saratoga Springs, beginning August 27, 1879.

WE are indebted to Dr. A. R. McNair, of the Local Committee of arrangements at Saratoga, for special and personal favors connected with the meeting of the American Association for the Advancement of Science at that place this week. Everything in their power has been done by the committee to secure low rates of transportation and boarding for members and visitors, and all attending will receive a warm welcome.

WE have received from Lindsay & Blackiston, too late for notice in this number of the REVIEW, copies of Bloxam's Laboratory Teaching, a handsome illustrated volume of 261 pages; $2; and Wilson's Summer and its Diseases, being the third of the American Health Primers for popular reading; 50c.

THE Report of the President and the Board of Education of the Kansas City Public Schools for 1878–9, which should be read by all parents and guardians of children in this city, will be found to contain many gratifying items of information relative to the management, cost of maintaining, course of instruction and progress of these schools. We presume that very few tax-payers realize that, with the remarkable increase in the number of scholars, the school tax has actually been reduced to the lowest rate ever levied, instead of increased, and that $25,000 of principal and interest of the school debt of this district have been paid off within the present year. Nor is it generally supposed that the children of this city can be educated at a total expense of 3.9 cents per day each, and yet such is the case, supposing all the scholars enrolled to be in daily attendance.

Well deserved compliments are paid by the board to Superintendent Greenwood and his corps of teachers, and the thanks of the community are certainly due to the board for their faithful and efficient management.

THE Academy of Sciences of Vienna announces the discovery by Polesa, at Vienna on the 21st of August, of a comet, in ten hours and two minutes right ascension, forty-nine degrees and six minutes north declination, with a daily motion of plus six minutes minus three minutes.

MORE space for the display of agricultural machinery at the Kansas City Exposition this fall has already been secured by exhibitors than was occupied by them all last year, although that was considered by everybody as the finest display ever made in the West

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PROFESSOR C. W. PRITCHETT, of the Morrison Observatory at Glasgow, Missouri, proposes to supply Kansas City with standard time by means of an electric time-ball, placed above the Union Depot and dropped each day precisely at noon. Mr. Nettleton, manager of the Union Depot, and Mr. McMullin, Superintendent of the Chicago & Alton Railroad, are considering the matter and propose to make the necessary arrangements as soon as practicable.

Such a ball has been in operation at New York for over a year without a single failure, and is always within 0.5 of a second of absolute correctness.

Although this will be no little trouble to Prof. Pritchett, he proposes to operate the time-ball the first year without charge, if the railroad companies will provide the connections, ball, etc.

PROFESSOR INMAN, of the Larned *Chronoscope*, is spoken of for Governor of Kansas in 1880. As he is a practical scientist instead of a politician, his nomination is somewhat uncertain, but if elected he will be one of the most intelligent and energetic governors the state has ever had, and the necessities of the plains, on which he is enthusiastic, will by no means be overlooked.

THE citizens of Denver have organized a Historical and Natural History Society, the main object of which is the preservation of records, personal narratives, documents, relics, etc., also the accumulation of books and specimens of mineral wealth which so abound in Colorado. If properly managed, there need be but little delay in obtaining the finest collection of such things in the United

States, as every single citizen, great or small, has already on hand from one hundred pounds to as many tons of ores, fossils, etc., of which he will be glad to contribute to such a cause.

EXTREME cold and fumigation having both failed as destroyers yellow fever germs, it is now proposed to effect their destruction by heat, and the use of steam is recommended as the most convenient, safe and effectual means of applying the heat. This suggestion is based upon the Persian treatment of the plague—infected patients being cured by subjecting them to a bath of air heated to a temperature of 112° to 130° Fah.

THE hottest day of August, according to our thermometer, was Monday, the 4th, when the mercury stood as follows: At 7 a. m., 81°; at 2 p. m., 94°; at 10 p. m., 85°.

A GERMAN traveler, Otto Schult, addressing the Lisbon Geographical Society, August 22, says he has made a pretty exact survey of the region between the Quango and Cassai rivers, in Africa.

ITEMS FROM THE PERIODICALS.

THE London England, *Monthly Journal of Science*, opens with an article upon "England's Intellectual Position," in which the writer sharply criticises the manner and character of the teaching done in her universities, and institutes several unfavorable comparisons between the influence and position in the world of her scientific and literary professors and those of America, Germany and other nations. This, he attributes to the deplorable English system of education and not to any inbred deficiency of the countrymen of Newton, Faraday, and a few living biologists and physicists.

AN editorial article in the London *Telegraphic Journal* for August describes the results of the use of the electric light on the Embankment, and states that after several months of experiment with the Joblochkoff's candles, the Metropolitan Board of Works has concluded that they have decidedly the advantage over gas in price and lighting power, and has ordered an extension of the candles over Waterloo bridge and up Northumberland Avenue. This shows that this great invention is slowly but surely making headway, and foretells the final general adoption of a cheaper and better light than we now have.

IN the London *Chemical Gazette* for August Dr. T. L. Phipson, who has been publishing a series of articles on "The Analysis of Water," with copious examples, alludes to the presence of phosphoric acid in potable waters as an important indication of sewage contamination, and describes the water of the river Dart as containing 52.50 grains per gallon of residue, consisting of 17.52 grains of Nitrogenous organic matter, 3.25 grains of Phosphoric acid, and 31.75 grains of Carbonate of Lime, Sulphate of Lime, &c., and yet the water was only "somewhat turbid," deposited only a "slight amount" of organic matter and was neutral to test paper.

AN interesting account is given in *Iron* (London, August 2d) of the Annual Meeting of the Institution of Mechanical Engineers, which alternately holds its sessions in London and the provinces. On such occasions excursions are taken in all directions, and all of the manufacturing establishments of the locality are minutely and intelligently inspected. This year the institution meets in Glasgow, where such establishments are peculiarly attractive, from their great number and extent, their almost endless variety, and from their great age, in cases like the Rollox works, which commenced on a small scale in the latter half of the last century and are now the greatest chemical manufactories in the world.

THE London *Journal of Applied Science*, edited by Prof. P. L. Simmonds, a scientific writer of distinction in England, contains a full monthly summary of progress in the industrial arts, compiled from all available sources, and is one of the most useful publi-

cations that reaches our table. The office of the editor has lately been removed to 61 Cheapside.

A VERY interesting description of the University Observatory, Oxford, England, is given by Professor C. Pritchard, F. R. S., in the *Observatory* for August, from which it appears that although the means of instruction are unusually ample, the number of students in this branch is quite limited, owing to the the fact, as is gravely stated by the Professor, that such rewards as are offered for proficiency in other studies are not held out to students of astronomy. During the Michaelmas term, but fourteen students attended the astronomical lectures; in the Hilary term, two; in the Easter and Trinity terms, ten.

ACCORDING to *The Farm*, published at Dublin, Ireland, the statistics of that country show by no means a flattering picture, indicating, as they do, a falling off in the production of nearly everything in the agricultural line, and a withdrawal within the past five years of not less than £5,699,780 from the only industry Ireland possesses.

Sunday Afternoon, of which we have several times spoken, as a most excellent household Magazine, and one which is highly appreciated wherever read, enters upon a new volume and assumes the new title of *Good Company* with the October issue. We see no advantage in this change of name, but suppose it has been made to disabuse the minds of certain over-suspicious persons of the erroneous idea that it was a strictly religious and therefore necessarily uninteresting Magazine. The editorial management remains, as heretofore, in the hands of Mr. E. F. Merriam, and the list of contributors insures a continuation of the sprightly, instructive, first-class, moral articles which have heretofore characterized it.

THE essay in the *Sanitarian* for August, by Dr. Chas. Denison, of Colorado Springs, Colorado, upon "Out Door Life," is fully worthy of the leading position in that excellent journal, and one that should find place in all the Hygienic periodicals of the land. It is not only well written, but it is backed up by indisputable facts; and, while it is intended mainly as an argument for Colorado's delightful climate, the points made apply with full force to life out of doors anywhere, except in swamps and in the alleys of filthy cities.

NOTHING we have seen on the subject of Summer Resorts, this season, has so attracted us as the impressions gained from the *Chautauqua Assembly Herald*, of the delightful combination of pleasure and profit, idleness and instruction, *san souci* and science to be enjoyed by the visitors at Lake Chautauqua, N. Y., during the hot weather. Aside from the satisfaction to be derived from the cool atmosphere, charming lake scenery and the fascination of sailing and fishing, there is an Annual Sunday School Assembly at what was once known as Fair Point, now Chautauqua, at which all the distinguished preachers and teachers, and many well known scientists and visitors, are present and devote themselves to elegant and useful recreations, such as scientific lectures, sermons, literary essays, &c. All these are reported in the *Herald* and sent all over the country. It is a large, handsome, eight-page paper, well edited, and very cheap at the price of $1.60 per annum, daily during the vacation season, and monthly the remainder of the year.

WE learn with regret that the *American Quarterly Microscopical Journal*, which has been so ably edited by Prof. Romyn Hitchcock, will be discontinued with and after the July number.

THE *American Naturalist* for September publishes a highly appreciative testimonial to Dr. Elliott Coues, U. S. A., signed by Huxley, Darwin, Mivart, Wallace, Günther, and other eminent zoölogists of England, expressing their warm approbation of the Bibliographical Appendix to his work on the Birds of the Colorado Valley.

IN the *Mirror of Progress* for August 23d, we find an interesting geological article from the pen of Judge West, entitled Following the Pick and the Spade, conveying valuable information relative to the formations of this locality.

AMONG the many valuable articles offered by *Van Nostrand's Engineering Magazine* for September, none perhaps will prove more interesting to the general reader than that entitled "The Work of the smith in the Sixteenth, Seventeenth and Eighteenth Centuries," while to the technical ones, doubtless, those on "Logarithms," by Prof. Merriman, and the "Mathematical Theory of the Motion of Fluids," by Prof. Craig, will be studied first.

PROF. S. F. PECKHAM, of the University of Minnesota, in a late letter to the *Chemical News*, calls attention to his article in the *American Journal of Science*, attributing the explosions in the flouring mills at Minneapolis, May 2, 1878, to the cause suggested in the REVIEW for that month, and confirmed a few days later by the verdict of the jury, viz.: the sudden ignition of a large amount of inflammable dust floating in the atmosphere, the force of the explosion in the first mill carrying the flames through the windows in the second and third, etc.

THE *Atlantic Monthly* for September, contains; Cæsar's Art of War and of Writing; Miss Magdalena Peanuts, Phœbe Yates Pember; On Latmos, Miss L. W. Backus; Mountains in Literature, Thomas Sargent Perry; Irene the Missionary, XXIII–XXVI; Married Bohemians, Edgar Fawcett; The Use of Numbers in Society, N. S. Shaler; The Race, and Why Yale Lost It; American Finances from 1789 to 1835, II., John Watts Kearny; Genesis, Ernest Dale Owen; Songs and Eccentricities of Birds, Wilson Flagg; A Tennysonian Retrospect, Julius H. Ward; Recent Novels; A Lesson in Picture, Sallie M. B. Piatt; "Nobility and Gentry," Richard Grant White; A Word to Philosophers, Christopher P. Cranch; Story-Paper Literature, W. H. Bishop; The Contributors' Club; Recent Literature; The Jennings Sanitary Depot and Colonel George E. Waring.

THE *North American Review* for September presents the following attractive table of contents: The Genius of Nathaniel Hawthorne, by Anthony Trollope; The Standard of Value, by Professor Simon Newcomb; The Work and Mission of My Life, Part II., by Richard Wagner; The Diary of a Public Man, Part II.; Confession of an Agnostic, by an Agnostic; Intrigues at the Paris Canal Congress, by A. G. Menocal; Three Important Publications—Finlay's History of Greece, Pattison's Renaissance of Art in France, Cox's Aryan Mythology—by Mayo W. Hazeltine.

Appleton's Journal for September is at hand and, as usual, is filled with excellent matter. Its book reviews are always especially noticeable for their thoroughness and truthfulness. Among the numerous good articles, those upon A Venetian Night, by Miss Adams, and An Hour with Thackeray, by John Esten Cooke, are particularly attractive. The serial stories are well sustained, and the whole number is fully up with its contemporaries.

THE *Popular Science Monthly* for September has not yet appeared upon our table, being behind-hand for the first time in almost three years. Not one of our exchanges is more missed when not promptly received.

KANSAS CITY

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GEOLOGY AND PALÆONTOLOGY.

BOTANY AND EVOLUTION.

BY PROF. B. F. MUDGE, MANHATTAN, KANSAS.

PLANTS CONTINUED—DICOTYLEDONS—RECENT.

(*Continued.*)

The great era in plant life, and the most important and radical change in vegetable structure during our whole geological history, was the introduction of the Dicotyledonous form. It includes all the common cultivated and forest trees and shrubs of the Temperate Zone—except Conifers—having a net-veined leaf and annual ring of growth, with two cotyledons in the embryo. It embraces the first fruit-bearing plants* which could furnish food for man or most of the herb ivorous mammalia. At the beginning of the Cretaceous Age the Dicotyledons appear in numerous forms, without any predecessors connecting them with the vegetation of the preceding ages. The Pine, their nearest allied type, had been in existence during nearly one-half of the period of the organic history of the globe, or, not less than twenty millions of years, and left no tree more nearly connected than the first trunk of the Silurian. At their first entrance on plant history, the Pines had representatives of the important types of our own day, but not one diverged toward the Dicotyledons.

* Palms furnish food, but they were not common until after the existence of the Dicotyledons.

The Dakota, or lowest group of the American Cretaceous, affords, according to the careful labors of Prof. Leo Lesquereux,* not less than one hundred and sixty-four species of fifty-two genera, and nineteen orders of Dicotyledonous plants; and new species are constantly being added to them. All these are found over an area but slightly examined, having a vertical thickness of not over five hundred feet, while the total thickness of the strata containing fossils has been estimated at from eighty to one hundred thousand feet. Prof. Lesquereux is very explicit in expressing his opinion of the newness of the flora and of its resemblance to our present vegetation. He says: † "But the Cretaceous flora does not preserve any traces of ancient forms known of old. * * * They represent Phænogamous [bearing true flowers, embracing all the highest forms of vegetation] plants, distributable not in a single one, but in all the essential groups of vegetables living at our time. * * * All these types are, therefore, present in the North American flora, some of them with scarcely any alteration of forms." They include the Oak, Willow, Poplar, Beech, Laurel, Sassafras, Magnolia, Maple, Birch, Hickory, Cinnamon, Fig, Plum, and Apple (*Pyrus*), besides many small and inconspicuous shrubs. The different genera are as equally well marked and distinct as those of the present day.

We would call particular attention to the fact that the flowering plants of the highest genera and most perfect type appeared among the first Dicotyledons, as a contrary statement has been frequently made by writers favoring evolution. If any one will consult the writings of Lesquereux, Heer, Saporta or Schimper, or, what is more proper, the rocks of the lowest Cretaceous, he will find a full proportion of the highest rank (*Polypetalus*) at the first dawn of the Dicotyledons. Among them he will have the splendid Magnolia and Tulip-tree, and our fruit-bearing *Prunus* and *Pyrus*, or Plum, Pear and Apple. The highest and lowest Dicotyledons appear suddenly, together with the Apetalous, Monopetalous and Polypetalous, and in about the same proportions as they now exist. They all appear without predecessors, though in Colorado the underlying strata are conformable, without any interval in the continuity of the deposits. The distinguished palæontologist, Prof. Lesquereux, uses the following clear language on this point: "And the conclusion, evidently forced, at least in considering the flora of the Dakota group, is that its disconnection from ancient types is so wide that even the supposition of intermediate unknown vegetable types fails to account for the origination of its peculiar characters. * * * No trace of a leaf referable to a Dicotyledonous species has been recognized anywhere before the Cretaceous." (Flora, pp. 35 and 36.)

This feature of resemblance to living vegetation is increased by the examination of specific forms. At first Lesquereux was disposed—like all palæontologists who find familiar forms in an unexpected geological age—to decide that all the species were extinct, and he so assigned their names. But in his later writings,

* See Cretaceous Flora and other publications of that distinguished Palæontologist.

† Cretaceous Flora, pp. 37 and 40.

after exchanging opinions with the best fossil botanists of Europe, he has been led to change his decision, at least concerning one species. Prof. Lesquereux names one of the Sassafras leaves, found in the Dakota of Kansas, *S. Mudgei.* But in a more recent discussion of the resemblance of the fossils of this whole group to the living forms, he says: "Comparing leaves of *Sassafras officinale* [the living plant of the United States] with those represented by Count Saporta in the Flora of Sezane, and the specimens of *S. Mudgei* from Kansas, it is impossible for me to recognize any character, even any specific difference, by which these leaves could be separated." * And Prof. Schimper, referring to *Sassafras cretaceum*, another Kansas specimen, says: "Those leaves, very variable in size, present such a remarkable likeness to *S. officinale*, now living in North America, that one would be disposed to consider them as belonging to an homologous species." †

It is a peculiar fact that, while we have but one living species of Sassafras in the United States, we have at least six from the limited area covered by the Dakota in Kansas. The genus began with numerous species and ended in one.

Sassafras primigenium, from the Cretaceous of Greenland, appears to be in the same category. Thus we have the highest authority for stating that not only more than half of the genera, but even some species of the oldest Dicotyledonous trees, are now growing in the Temperate Zone. Further examination by our eminent floral palæontologists will undoubtedly add other species as living representatives of this old, early vegetation. The Fig (*Ficus*), of which Lesquereux describes several species, shows a close resemblance to several now growing in Cuba and Florida.

Taking Prof. Lesquereux's list of the Dicotyledons of Dakota, we find fifty-six per cent of his genera are identical with those now living in the Temperate Zone of the United States east of the Rocky Mountains. To this must be added twenty-four per cent which are apparently identical, represented by Populites, Betulites, Acerites, Negundoides and others. Of the remaining twenty per cent, a few like the Fig and Cinnamon are now tropical, while some are of extinct genera, "not referable to any of the types of our present vegetation."

The great and sudden change in the vegetation at the opening of the Cretaceous Age has been noted by European evolutionists, and explained by the fact that in that quarter of the globe a marked break occurred between the Jurassic and Cretaceous. It was claimed that if the connected history of the two formations could be found, it would give the missing links between the old and new vegetation. But the labors of the geologists in the Rocky Mountain region have found these formations pass into each other, without any chasm or break in the continuity of the strata, all being conformable; yet we have the same sudden and abrupt change in the type of the vegetable life that has been seen in Europe, pressing so hard on the evolution theory. Along the "foot-hills" of Colorado, from Morrison to Cañon City, a distance of over a hundred miles, the

* Geological Survey of the Territories, Hayden, for 1874. p. 328.

† Traite de Paleontologie Vegetale, vol. iii, p. 598

writer has found Dicotyledonous leaves abundantly in the Dakota on the tops of the hills, and two hundred feet below were the unmistakable fossils of the Jurassic. In the thousands of feet of the homogeneous, conformable strata below, not a trace of a Dicotyledonous plant could be found. The missing links in vegetation are just as decidedly absent as before the connection of the two formations were discovered.

It is also an admitted fact that the first Dicotyledonous trees were none of them of a lower type than those now flourishing. Man might have lived on the fruit of the Fig, Palm and Pyrus, by cultivation, then as well as to-day. The resemblance of the flora of the Dakota to the modern is also seen in the Redwood (*Sequoia*)—the genus to which the wonderful big trees of California belong—which is also found in this geological group.

When, therefore, there is so large a generic, and even some specific identity, between our common fruit and forest trees and those which lived not less than six millions of years ago, we are justified in concluding that there is little if any development or evolution in this branch of organic nature, and the variation, considering the enormous lapse of time, is confined to a very small circle.

Quite recently Dr. Oswald Heer, in reporting upon the fossil plants brought from Greenland and Spitzbergen, by the two Swedish expeditions of 1870 and 1872, in the summary of the results, states clearly that the facts are against a gradual transformation of plant types. His facts in relation to the resemblance of the Cretaceous and living vegetation agree very nearly with those of Prof. Lesquereux. In the Upper Chalk of those countries, as in our Dakota, the Dicotyledons appear suddenly in great varieties, representing closely our living genera.

Among all our fossil plants, there is no order not found living although, on the authority of Hooker, two hundred orders are known. In other words, if we admit evolution, there has not been sufficient change in plant life, marine or terrestrial, in all earth's history of not less than fifty millions of years, to advance a single order beyond its original characters. Nor, on the other hand, has earth's change been able to destroy an ordinal type.

If we study carefully the history of living vegetation, we shall find that the great stability and persistence of form which we have noticed in the fossil Pines, Cycads, Palms and Dicotyledons remain to-day. Though we find no two flowers, no two apples or other fruits just alike, yet all these variations are restricted to a narrow limit in each species. The marked variation which we notice in a single season is scarcely changed in ten, and not increased further in a hundred. Though man's agency—powerful, if you choose to call it so—may increase the variety, it never goes beyond the specific bounds. The barley found charred in the ruins of the Swiss Lake dwellings, believed to be many thousands of years old, is identical with that cultivated in modern Europe. While we need not credit the story that wheat embalmed with mummies has germinated, it is admitted that such wheat has been found. Such grains, together with the pictures in the old tombs and early descriptions by historians, induce us to conclude that

Egyptian wheat was not materially different from that now cultivated in North America. So the fruits and seeds from Pompeii have been identified with those now growing in southern Europe.

The history of living vegetation runs in harmony with the fossil. European civilization and emigration have carried the plants of that quarter of the globe to almost every other clime. Many, both useful and noxious, have lived and flourished under most diverse circumstances. Whenever they have been planted in soil or with climate too uncongenial for their habits, they have died, but never changed to new species. Many of our troublesome weeds have been introduced from Europe and have spread over nearly all parts of the United States, from the moist climate of the sea coast to the dry plains of Colorado; but never has a new species, much more a new genus, been developed Two hundred and fifty of old England's weeds are found in the fields of New England without change of features. Many have gone to Australia with the same result. The efforts to acclimate foreign plants in Europe have shown the same result. For hundreds of years there have been hot houses and botanical gardens all over Europe, subjecting the vegetation of all climes to new surroundings, but no plant has assumed a sufficiently new form to induce botanists to recognize it as a new species. Some of hardy temperament have changed sufficiently to be called new varieties. The artificial atmosphere of hot-houses has usually dwarfed tropical shrubs, without causing them to change in other respects. Oranges, bananas and pine-apples have still remained such. Palms have lost their vigorous growth, but have never become degraded to a lower form. If, in all the artificial life surroundings which man with his high intellect is able to give to plants, we have so little change, will unassisted nature do more?

The common domesticated farm and garden vegetation furnishes numerous illustrations of the persistent law which controls plant life. Our winter and spring wheats are varieties of one common stock—*Triticum vulgare.* This species includes nearly all the cultivated wheat, which numbers over three hundred varieties. Notwithstanding *Triticum vulgare* assumes so many phases, which are constantly increasing, it shows no tendency to intermingle with the other species of *Triticum,* though human agency is far more powerful in creating varieties than unaided nature. Wheat never changes to chess, nor chess to wheat. Nor has all human agency been able to change the features of any other species of *Triticum* so as to furnish a good bread wheat. The varieties of Barley are from three species of *Hordeum* (*distichum, hexastichum* and *vulgare*), but no food grain can be procured by the cultivation of the other species of *Hordeum.* These species, cultivated with all our care, never intermingle. No hybrid can be found. Rye is from *Secale cereale,* nearly allied to wheat in botanical character, and has been cultivated with the other cereals from the earliest times, under the same circumstances, by the same human agencies, but neither grain has shown any tendencies to assimilate with the other or to assume a common form. If like circumstances produce like results in the botanical world, these grains should long ago have become one, or at least assumed new specific traits.

Wheat, Barley and Rye illustrate another characteristic of plant life. The first is very flexible and protean in forms and varieties, while the others are the reverse. Yet each is exceedingly persistent in retaining not only its generic, but its specific features. Each is true to its own circle of vitality. All have been cultivated during unknown ages, from the dry, hot valley of the Nile to the cold, damp regions of northern Europe, on the Alps and in sunny Italy, yet man has never been able to develop a new species. So with all our common esculent roots. We can produce new varieties of potatoes, beets, water-melons, musk-melons and the other garden products, but we have not, with all our skill, been able to make a new species.

In our cultivated fruits we find more diversity, but without passing the line of species. Downing reports about 3,650 varieties of Apples raised in America. Yet all are Apples. They have common traits and habits, with no tendency, in all our varied culture, from Canada to the Gulf and from Maine to California, to become anything but Apples. There is no disposition in these three thousand six hundred and fifty varieties, though they are constantly sporting, to commingle with the nine hundred varieties of Pears cultivated in the same orchards. This is the more worthy of notice as the Apple and Pear belong to very closely related species of the same genus—*Pyrus*. Both are exceedingly flexible, but each is restricted to its specific form.

In this connection, grafting, an abnormal product of the art of man, is worthy of notice. The Pear is frequently grafted on the Quince root (*Cydonia vulgaris*), a plant different in generic as well as specific structure; yet the stem, bark, leaf and fruit not only adhere to the true Pear form, but even the variety of Pear is preserved. If it be a Bartlett, it still retains the shape, color, flavor and every other trait of that well known fruit. The root is still Quince, but all above the point of grafting is still a Pear.

If the cultivated plants vary so little under the fostering hand of man, we cannot expect to find any greater change in wild, unaided nature. Hardy plants may have a very extensive range under diverse surroundings, but, instead of rising or sinking to new species, we find them holding their peculiar specific features as long as the seeds will germinate. Instead of changing, death ensues. All our common plants, to a greater or less degree, show this ability to endure a great extreme of soil and climate, the influence of circumstances being shown in a greater or less vigor of size and foliage. To make a list of such plants would require pages of this work.

Take the common Dandelion (*Taràxacum densleonis*). It is indigenous to Europe and America, and abounds from Kentucky northward, and from the moist shores of the Atlantic to the dry plains of western Kansas. The Polaris found it also in the most northern spot visited by man—in latitude 82°, or within eight degrees of the Pole. Its green and gold are just as strongly in contrast, and its seed furnished with a pappus just as lightly constructed, under all this diversity of circumstanes. The Gentian (*Gentiana*) is also a good illustration of the same

persistency under extremes. It flourishes along our ocean shores from Maine to Georgia, on the Rocky Mountains over ten thousand feet above the level of the sea, on the European mountains to the snow line, and on the borders of the desert of Sahara. In all situations it retains the same normal appearance in root, stem and branch, and does not even lose the soft, deep blue of its corolla.

It will thus be seen that Botany, so far from being that branch of natural history to favor or prove evolution, is in its record a constant revelation of a steady and strong adherence to normal types. No era of earth's history shows that vegetable forms, whether high or low, from their first introduction, have varied from their early characteristics.

The Fucoids, and other marine genera of the early Silurian, are represented by similar forms in the present seas. They still present the same soft, mucilaginous mass, without seed vessels, and with the most simple organizations. The fresh-water plants of the Carboniferous are very similar to those of our present swamps. The ferns and club mosses of our ravines and forests have no marked improvement in organization over those of the Devonian and Coal measures. The Pines, Cycads and Palms have varied so little from their first garb that if they were resurrected and placed in groves of their living representatives, they would give no new feature to the forest scenery. Even these changes, small as they are, have not been shown to be the result of evolution.

We admit that if evolutionists could show that, while the great mass of vegetation has been persistent and unchangeable, there were some, even a few, genera which have varied and developed into other genera, then the persistence of the mass would be no evidence against evolution. But no single instance has yet been shown, from fossil or living plant, that one genus has ever passed into a new generic form. With such an abundant evidence on one side, and none on the other, what must be the conclusion?

If plant growth is subject to such strong variation from a change of surrounding circumstances as evolutionists assume, why is it that, in almost every genera of vegetation, we find so many different species growing in the same valleys and meadows? From the oak to the orchis, and from the willow to the Violet, we find numerous species of the same genus living together. If species are the outgrowth of circumstances, why do the combinations of heat and cold, moisture and the want of it, darkness and light, produce so many species of the same genus in the same valley; or, when produced, why do they retain so persistently the same differences for long periods of time? Why, in the Dakota epoch, when the Dicotyledons first came into existence, were there growing on the same islands so many species of Oak, Willow, Magnolia and Plane-tree,* flourishing side by side with trees so antagonistic in structure and habit as the Fig, Palm, Cinnamon and Pine? All these, too, retain their generic and some their specific representatives to this day. Why do species each retain, even in the same meadow, the same color and odor peculiar to itself? The odor and color of flowers,

* Lesquereux has already described ten species of Quercus, six of Salix, five of Magnolia and six of Plantanus, and the explorations are only commenced.

though ever so striking, are such infinitely small component parts of a plant that the most subtle chemistry has seldom, if ever, been able to detect the substances which cause them. If like physical causes produce the same results in the organic world—and this is the cardinal principle of evolution—then plants of the same germs, growing in the same sunshine and same soil, should gather or elaborate that substance which yields the same fragrance and the same hue. The "environment" is the same for all.

The incongruity of plants entirely dissimilar in structure and fruit, living under the same circumstances, has not escaped the observation of writers in our current literature. Hawthorne, in his Stories from an Old Manse, speaking of the beautiful water-lily (*Nymphæa adorata*), says: "Why is it that this perfect flower derives its loveliness and its perfume from the mud out of which others draw such obscene life and noisome odor?"

FOLLOWING THE PICK AND THE SPADE.

BY JUDGE E. P. WEST, KANSAS CITY.

Amid the bustling scenes of the ever pressing activities and needs of life spanning man's brief abode among the picturesque hills and valleys environing the confluence of the greatest of North American rivers with one of its principal and most attractive tributaries, we seldom pause to think of the evidences of geological and topographical changes which lie buried at our very feet.

But those who will take the pains to observe closely what is revealed by the pick and the spade in the ordinary pursuits of this busy age, at Kansas City, will find many things of interest to attract their attention pertaining to changes and events long since past. Evidence will be found of the working of silent forces which effected stupendous changes millions of years before the voice of man was heard or his energy impressed upon the earth's solid crust. The imagination must be permitted to run back to the close of the Upper-measure formation, and its subsequent elevation to near its present level, and follow the changes which have since taken place. At this time, where West Kansas City now stands in a deep valley, there was a continuous line of the high bluff bounding the Missouri River filling the gap now cutting across the the Kansas River valley from Bluff Street, in Kansas City to the high point of undisturbed stratified rocks near the center of the city of Wyandotte, Kansas. The channel of the Kansas River, through which its waters then flowed, was along the McGee Creek valley, and Goose-neck Creek valley, and its confluence with the Missouri at or near the present mouth of the Big Blue River, in Jackson county, Missouri.

Since the close of this era all the ravines and channels about Kansas City and Wyandotte, whether now exposed to view or remaining buried beneath the Loess deposits, have been cut through the solid stratified rocks to their present

depth. Two well marked geological epochs which have transpired since the close of the Carboniferous era will afford some clue to the order of their occurrence; we allude to the Drift era which marked the first great change, and the Loess epoch, which was subsequent. The Drift is well marked by erratic deposits of transported sand, gravel, and boulders, and the Loess is equally well defined by the brick clays, from which our superior quality of bricks are manufactured in Kansas City. The channel of the Missouri River was cut to a depth greater, perhaps by two hundred feet, than now marks the bottom of the river, the area of country lying north of Seventh Street and between it and the river, extending from the junction of Sixth Street and Bluff Street, in Kansas City along the general line of Seventh Street east, bending in from Forest Avenue by Dikington Park to the river valley, was denuded by the attrition of the Missouri River down to the Bethany Falls limestone, and most or all the ravines pointing in to the two rivers, as they then ran, were worn away before the Drift epoch was ushered in. This is proved by the drift which fills the old channel of the Missouri River to a depth, perhaps, of two hundred feet below the present bed of the river, and which rests, buried under the Loess, on the Bethany Falls limestone in the denuded area before defined, and which is to be found, covered under the Loess, in the old ravines pointing northward to the Missouri River. But a significant fact, which will be alluded to hereafter, must not be overlooked, namely that the Drift deposit is not found in this vicinity south of the Bluffs marking the south bank of the Missouri River. The high, narrow promontory which formerly divided the Missouri River from the Kansas River between their present confluence at Wyandotte and their former confluence, at the mouth of the Big Blue River, has been cut through in two places. One between Kansas City and Wyandotte, where the Kansas River now empties into the Missouri, embracing the present Kansas River valley, at its mouth, and the other not so wide but well defined, extending from McGee Creek valley, in the southern portion of this city, to the Missouri River, along and embracing Grand Avenue, a part of Walnut, Main, Delaware and Walnut Streets. These channels or gaps through the previously continuous bluffs, were made, no doubt by the action of the currents of both rivers cutting away from the opposite sides of the narrow promontory dividing them, by exceeding slow advances, during the almost immeasurable time intervening between the close of the Carboniferous age and the beginning of the Loess time. This view is sustained by numerous considerations. In the first place, there is no other apparent cause which could have accomplished the stupendous work of removing so formidable a barrier, while the cause assigned would be fully and naturally adequate to the task. And, besides, this is rendered more probable by the conformation of the bluffs, both along the Missouri River and the Kansas River. The bluffs on the Kansas River toward its mouth bend to the northeast, while those along the Missouri river, above and in the same vicinity, curve to the southeast. In the next place, these channels could not have existed during the activities of the Drift era, or the erratic Drift deposits would be found south of them lodged against the Kansas River and McGee Creek valley bluffs, as

they are found east lodged against the Missouri River bluffs, on the south side and west of them, lodged against the Kansas River bluffs on the south side. The deposit west of the mouth of the Kansas River extends some miles further south than those east along the Missouri River bluff, and along the bluffs south of the gaps there is none to be found at all. So these gaps, one of which now forms an outlet for the Kansas River, must have been chiseled through the solid bluff by the action of the water, after, or about the close of the Drift epoch. The work was aided, perhaps, by an increased volume of water in consequence of the melting away of the glaciers, which had previously existed, about the close of the Drift period. Numerous erratic blocks of the Drift are found in Wyandotte county, Kansas, as far south as the south bank of the Kansas River, and they can be found in Jackson county, Missouri, as far south as the bluffs on the south side of the Missouri River, but not south of those lines.

The remains of extinct mammals have been taken from the Drift, at Kansas City, and the evidence of man's presence has been found embedded in the Loess, under circumstances to render it certain of his presence in this vicinity, while the Loess deposit was yet going on. The old slopes of the bluffs and ravines as they were before the Loess deposit buried them under its thick mantle, are revealed sometimes by the attrition of water, and sometimes by man's industry. Two examples of the latter may be named. In grading the block on the northeast corner of Seventh and Walnut Streets, after removing about fifty feet of Loess, the old slope of the bluff was encountered and uncovered on the south side of the block. Seventh Street, at this point. was graded along the north slope of the bluff bounding the river on the south, as it was before the Loess deposit covered it in and filled up the denuded area before alluded to, over the Bethany Falls limestone in this district. The other example is to be found at the intersection of Ninth and Main Streets. In excavating the lot at the northeast corner for the basement of a building to be erected thereon, after removing five or six feet of soil and Loess, the slope of the bluff bounding the east side of the old channel extending from McGee creek to the Missouri river was encountered, and the debris removed from the east end of the lot; but excavation terminates at the west end, in the tumbled down rubbish still resting on the surface of the old slope. The owner of the property would do well to look closely to this matter before putting in the foundation of the house to be erected, and save perhaps by doing so thousands of dollars which may be wasted in pulling down cracked and broken walls, after the building is erected.

The cut on the Hannibal & St. Joseph Railroad west of the bridge, and the cut on the St. Louis, Kansas City & Chicago Railroad west of Main, and at Grand Avenue, disclose the Drift resting on the Bethany Falls limestone, buried under more than a hundred feet of Loess.

Numerous matters connected with long past events of great interest to those who are fond of studying past changes, revealed by the pick and spade, might be considered, but our space will not permit of it at present.

—*Mirror of Progress.*

THE STONE AGE IN KANSAS.

BY W. H. R. LYKINS.

The town of Lawrence, Kansas, is situated upon an irregular bench or terrace extending for some distance along the south side of the Kansas river. In the western part of the city where I have more particularly examined this terrace formation it is constructed as follows:

1. Soil two feet. 2. Gray and brown clays interspersed with small stones twenty-five to thirty feet. This bed has evidently been formed in the course of time by washings from the adjacent hills. 3. Coarse river sand and gravel three to five feet. When this bed is reached permanent wells of fine water are obtained. This was doubtless an old bed of the Kansas river when it ran at a much higher level than at present, as the material of which it is composed is identi al with that found on the sand bars of the Kansas. 4. Blue shale twenty feet. The whole rests upon the Carboniferous limestone which crops out at the water's edge. These measurements are from memory, my original notes having been lost, but are near enough for the present purpose.

Passing one day along Louisiana street near where a well was being dug, I stopped to examine the work. The diggers had just penetrated No. 3, or the old river bed, several tubfuls of which had been thrown out. While working over the heap looking for curiosities, I came upon a veritable worked flint. There could be no mistake about the locality from whence it came, as it was still wet and stained the same red ocherous hue as the associated stones and pebbles. This implement was of an irregular oval or leaf shaped pattern, about four and one half inches long and two and one fourth inches wide. One side to the point had been dressed to a cutting edge, the other side had been left nearly in its natural state, and it seemed to have been used for scraping or skinning. While the workmanship was rude, its artificial character could not be mistaken by any one accustomed to handling worked flints; the regularity and peculiar conchoidal fracture of the chippings showing plainly that it was the work of human hands. The material of which it was made was the common blue flinty stone found in the surrounding hills. Recognizing at once the importance of my discovery, I made an accurate section of this part of the terrace which, with explanatory notes and the implement itself, I designed sending to the Smithsonian Institution, but the whole was unfortunately lost a short time afterward, on that memorable 21st of August when Lawrence went down in fire and blood at the hands of Quantrill and his guerrillas. Now while I do not expect my discovery to take its place as an authenticated find, the evidence of its authenticity being lost, I desire to place the fact upon record in order that other observers who may have the opportunity may be on the look out for such relics in similar situations. In 1852 I saw a tooth and some bones of the mastodon taken from this same old river bed in a well being dug near Silver Lake some miles above Topeka.

I have in my possession at present an interesting relic found on the Shunga-

nunga, near the great mound south-west of Topeka. It was found about three feet below the surface by some parties who were digging down the bank of the creek to make a wagon road. It is a symmetrical keystone four inches in length by two and one inches in width at the ends, made of a pale blue stone not found in that part of Kansas. The upper end has a small round hole in it much worn as if by a string by which it was probably hung around the neck of its owner. It appears to have had some hieroglyphics or figures on it, but it had been used by the person who found it as a whetstone, which has nearly obliterated the markings. Many fragments of old Indian pottery were found at the same place.

Some of the Indian tribes used flint implements down to a very late day. About 1840 a party of Kaw Indians came to our farm near Westport, Missouri, on a trading and begging expedition. Some one on the place traded a pig for a dressed buffalo robe. The Indian killed it with an arrow and turned it over to his squaw who took from her belt a piece of white flint about five inches long and two inches wide, square at the ends but very sharp on the sides, with which she skinned the pig as quickly and neatly as a butcher could have done it with his knife. The Indian boys at that time still made and used flint arrow heads, and the medicine men prepared a sharp splinter of flint for bleeding and cutting.

POLITICAL SCIENCE.

BRITISH IMPERIALISM AND THE AUTONOMOUS RIGHTS OF RACES.

BY A. H. THOMPSON, TOPEKA, KANSAS.

(*Concluded.*)

The objection that may be made as to the insecurity of foreign life and property and the consequent check put upon commerce and enterprise under native rule, may be met by the consideration of the fact of the presence of the army of occupation of the foreign civilizing nation. It will, of course, be part of the duty of this army to protect foreigners, their life and property, and at the same time to protect the natives from injury and injustice by foreigners. The advantages of and safety to trade would be just as great, perhaps greater, under a civilizing protectorate as under the system of political conquest and government. There would not be the ever present desire to resent oppression and effort to throw off the yoke of the conqueror. Mutual faith and interest would, in time, inevitably promote mutual safety. The temptation to oppress, which is the natural accompaniment of power, would be absent, and mutual rights would be recognized and respected. The facilitation of barter and trade, the foreign ownership of property, mutual advan-

tages to both races by inter-commerce, and the development of native industry, would, we cannot but believe, be promoted with safety and success.

It may be objected, also, that the unrestrained practice of the racial autonomy system would lead to the formation of innumerable petty nations, some of them embracing a very limited territory and few people. We admit that this would be the inevitable and natural result. Yet, with most races, the extensive and comprehensive bonds of ethnic affinity and relationship, racial pride and patriotism, and uniformity or similarity of physical and mental characteristics, customs, etc., would lead naturally to the coalescence of related tribes. The size of a nation would then be governed by the numbers of each of the greatest divisions of races and sub-races, and petty schisms would be unlikely to occur, with the spread of intelligence, especially as division beyond a certain line would be discouraged by the united sentiment of nations. The system would, to a certain extent, be a return to the primitive petty subdivisions, but it would be none the less perfect and conducive to the greater happiness of the world, for all that. Every individual would be the happier to know that himself and his nation were "free," were their own rulers instead of the slaves of a foreign conqueror. This liberty would be enjoyed from the lowest man in the land up to the racial head and ruler, and patriotism would be a national enthusiasm. Independence contributes more than any other one thing to the happiness of a people, and foreign rule most of all to their misery. General and prevailing happiness would, we hold, more than compensate for any disadvantage arising from the subdivision of the species into petty nations, or for the failing to develop great and ambitious powers.

History teaches us in all ages that the overgrown nation must and will surely fall to pieces, and principally on account of the ethnical heterogeneity of the elements composing it. In the classic ages one great empire succeeded another, arising upon the ruins of predecessors, and to be in turn overthrown and succeeded by others. These powers were upheld by force and cruelty alone, and their downfall was usually sudden, swift and terrible. Forcible confederation of heterogeneous races was a treacherous and loose union, and danger lurked in the naturally rebellious bosom of every man. There could be no patriotism for a foreign government ruling by force and cruelty, and where patriotism was absent danger was ever present to the state. Heterogeneity soon found expression in misunderstandings and conflicts. Powerful rebellions arose, and the great power was no more. One tyranny was, however, merely exchanged for another, which in its turn conquered and annexed friend and foe alike, to be in its turn overthrown and supplanted by another. We learn from the examples of antiquity, and of later times, that the nation which adopts a policy of unlimited conquest, either for the purposes of mere national ambition to rule, aggrandizement of territory or for revenue, without regard to the ethnical relationship of the people conquered to herself, ventures upon a dangerous sea and where many a ship of state has foundered utterly.

No nation, no matter how powerful, can expect to cement many peoples of

antagonistic ethnical qualities into one harmonious whole. England is beginning to realize this truth in her experience with India. The Saxon and the Hindoo cannot affiliate any more than oil and water can be made to mix. Russia has been successful in maintaining the unity of her peoples under a most clumsy system, for the reason—by wisdom or accident—that her Asiatic, as well as European subjects, are really all of a general if not special relationship to the dominant tribe. There is perfect understanding of ethnical peculiarities and appreciation of mutual tastes and prejudices between ruler and people, which goes further than anything else in securing unity—further even than her despotism, to which her people are accustomed.

The nation that oversteps the bounds of ethnical right, as defined by nature, enters upon a system of murder and robbery that will inevitably bring about the just retribution of its own utter ruin. If the great nations of antiquity had been composed of related peoples alone, their national life would undoubtedly have been longer. Their fall has usually been attributed to the weakness brought upon their rulers by luxury and dissipation consequent upon the possession of ill-gotten, boundless wealth. This, in some cases, may have precipitated ruin and made the opportunity which the real cause—the ever present discontent of heterogeneous, subjugated peoples—was not slow to improve.

England has been committing the same blunder for centuries—that which brought ruin upon the great nations of antiquity—and is laying the foundations of a fearful retribution by the indulgence of her unbounded ambition and avarice. She is beginning to perceive the difficulties of Imperialism, but does not yet acknowlege her mistake, even when she has her hands more than full of governing foreign races. She cannot expect to make another Rome of herself and not pay the penalty of Rome.

The philanthropical system would put a natural restraint upon national and personal ambition, for nations would be circumscribed by ethnical limits. An Alexander or a Napoleon, a Rome or an England, would be impossible. Weak peoples would not be a standing temptation to the cupidity of the strong, and need stand in no fear of being conquered and absorbed by the first great power which picks a quarrel with them. All nations would be safer and longer-lived. The strong would not be ruined by the indulgence of ambition run mad and the absorption of heterogeneous races, and the weak would be spared from the greed of the powerful. The nations in severalty would have a mutual interest in promoting the cause of ethnical autonomy, and tribal union as well, and would unite to prevent the overreaching ambition of any one nation or ruler. This latter policy is, to a small extent, pursued by the rulers of the nations of Europe, but with the difference that there is no regard paid to the desires of the people. Intertribal wars would be matters for general surveillance and arbitration, and coercion of part of a people desiring independence would depend upon the amount of coercion required, cruelty, of course, being out of the question.

But let us illustrate by some cases in point, and observe the probable workings

of the civilizing-protectorate system among peoples. Take the case of the Zulus. They have a perfect system of government, and, except for its cruelty, it works well with them in practice. It is an absolute monarchy, beginning with the head of a family, or *kraal*, and ascending through one series of sub-chiefs after another until all power culminates in a head chief, or king. Through this system the king can make the remotest, lowest subject in the land feel his power. They have a code of laws, prosecute law-suits and settle difficulties between individuals, and between individuals and the governing power, with considerable justice. The system is perfect of its kind, and is capable of great good. The rights of life and property are respected, and large business interests, cattle raising, agriculture, trading, etc., are conducted with success and safety. Suppose now, that after British honor had been avenged by the defeat of the Zulus (which would be right so far), that England should restore their territory and independence and make a treaty with them compelling the king to suppress and prevent cruelty, slavery and oppression among his people, and permit teachers and missionaries to reside among and instruct them; and then let them govern themselves to please themselves. England would, of course, be compelled to maintain a small military force on the frontier or within the kingdom, which would be an expense; but she would be more than compensated by the good done to the people and the safety rendered to British trade. She would, at the same time, be relieved from all the annoyance and expense of governing and administering law to a people she does not understand, whose thoughts and prejudices she does not comprehend. The people would be happier with their own rulers than under a better foreign government—according to European notions—which they do not understand. Can any one doubt the result? In one generation's time the people would be on their way to civilization. They would be happy and prosperous; the natural resources of their country would be developed; wealth would be accumulated, and, in a few generations, with education, the Zulus would become civilizers in turn.

But this glorious consummation we can scarcely ask, much less hope for. The autonomy of the Zulus, which is their birthright as men, must be sacrificed to British ambition and avarice. But if England should, by any fortunate, accidental disregard of precedent, do this grand thing, the result could only be of the happiest, for the Zulus possess a vigor of mind remarkable in savages, owing, doubtless, to their ethnical relationship not being specially negritic.

We are informed that the British commandant sent a protest to King Cettewayo against his cruelty to some of his subjects, some hundred of whom he had murdered for a mere whim. The haughty chief returned a defiant reply that he committed the deed "because it was a custom." Such "customs" should, of course, be interfered with and prevented. Cettewayo is a cruel, barbarous man, and should be restrained; but he is wily and intelligent, and is descended from a capable family, which, but for British dominion and conquest in South Africa, would doubtless have conquered the entire Cape country and established a

kingdom of some magnitude. The Dutch Boers acknowledged allegiance to them and other native chiefs and flourished under their government.

With restraint and education, Cettewayo's descendants would make good and capable rulers. Therein, and in the education of the people, lies the duty of Christian England to South Africa. If she forfeits this duty, if she prostitutes it to selfish gain, she deserves the anathema of Christian people in this world and just judgment in the next.

Suppose again, going back in history, that Spain had followed this principle in her treatment of the conquered peoples of Mexico and Central and South America, instead of robbing, murdering and destroying them. What interesting nations they would be to-day—how happy they would have beeu, and what good they might have done in the world by becoming civilizers in turn! But such a state of things could not have been possible then, much as we could desire it to have been so, and much as our blood boils over the indignities, atrocities and cruelties heaped upon the poor natives by the hell-born conquerors "coming in the name of the cross!" God save the mark!

In fact, a most interesting part of the subject is the contemplation of the interesting and picturesque peoples, and the variety there would be among nations, under this system, and of the delightful happiness of every people with customs, institutions and governments native to themselves, and with rulers of their own blood. It is, perhaps, hardly necessary to point to Switzerland, whose people have retained independence and being homogeneous, are happy, interesting, beautiful, and vigorous in mind and body, and having been free and unrestrained, have advanced in mental and physical development in their own way.

The effect of tyranny and foreign oppression is depressing and dwarfing on any conquered people. The effect of freedom being seen in Switzerland, but compare the contrast of Poland, the Slav countries, or Ireland, the victims of conquest and foreign rule. How they have suffered—what struggles they have made for liberty, and what bloodshed and misery these struggles have brought upon them! Scotland is a little better off, for she fought for and obtained certain rights. But suppose all these countries were and had been free and independent; what happy, interesting, and picturesque peoples they would now be! In the contemplation of such things, we do not believe that the principle of racial autonomy could be carried too far. It would fill its natural bounds and go no further.

Bringing matters nearer home, suppose that our own country had carried out this principle in dealing with the much abused and much abusing, "oft reviled and oft reviling," red Indian, the native races of America. This would not have been possible, perhaps, on account of the insurmountable practical difficulculties involved; but, passing these by, suppose our government had given more attention to these poor people, and treated them with something like justice, on the plan we have proposed. Nations might now exist here of whose peculiarities and possibilities the world has never dreamed. But it was not to be so; and, although we cannot restore life to the murdered thousands or return their

great, rich lands to the survivors, we can atone for a fraction of our crimes against the Indian by making some amends to the remnant of his race still living among us. We can do something for them by restoring to them territory and autonomy, by protecting them from themselves and others and educating and elevating them. We can give them the happiness that would be theirs when following their own customs and government. One thing has been pretty clearly demonstrated to our government, one would think, and that is that perpetual misunderstanding and misconception of the character and needs of the Indian will ensue so long as we persist in attempting to rule them as we would people of our own races, who are totally different and at variance with the Indian in almost everything. When the government of the Indian is transferred to his own hands, he will prosper and be happy, and not until then; for he, and he alone, understands the character and knows the needs of the race. The forcing of incomprehensible European civilization and customs upon him will continue to be, as it has been in the past, the one cause of his slow but sure extinction. He cannot adapt himself to them, for he comprehends nothing but the vices of the white man. The latter continues to covet and take the Indian's lands, even of the little that is now left, his avarice being the only excuse for the injustice and wrongs heaped upon these poor defenseless natives. All the benefits which have accrued to the selfish, soulless white man, do not compensate for the sacrifice of national honor and the compromise of every good and right principle.

One opportunity yet remains to our country in which to do justice, according to the civilizing-protectorate system, to a wild, interesting and deserving people. We refer to the natives of Alaska. For ten years since that valuable region came into our possession, the natives have been treated with a shameful neglect, a disgrace alike to our civilization and our Christianity. On the withdrawal of Russian occupation, Russian teachers and missionaries were also removed, and the people have been since criminally left to their own savage instincts. Fortunately, the Alaskans and the Innuits are a mild, intelligent, industrious people, so that they have not been as cruel and abandoned in their actions and treatment of each other as the red Indian would have been under the same circumstances of freedom from restraint. Recently there have been great efforts made by missionaries for their conversion and welfare, and these people respond, not by individuals, but by *whole tribes*, to the call. We have here, in Christian America, a wild and deserving people begging, reaching forth their hands toward us for instruction and help.

But what will the government do, with all its boasted friendship for suffering people? Just as it did with other wild tribes—let them alone until they revenge a repetition of injuries and wrongs inflicted by unprincipled white men, by murdering a few of them, and then send an armed force against the poor, defenseless Indians and shoot them down like dogs. That is "civilization," according to the Anglo-American idea. But, in the name of humanity and simple justice, why not anticipate the necessity of punishing and destroying them, by sending teach-

ers, missionaries and protectors among them? The Alaskans have a few customs which are cruel and degrading, such as the enslavement of women, which should be interfered with. Some church missionary societies are, however, doing what they can for the redemption of Alaska, and private effort will, we hope, even partially do what devolves upon the general government, rather than leave it undone. The people of Alaska are possessed of an unusual capacity for development, and if the American people would do their duty to them, by the expenditure of a small amount of means and effort, an empire could be erected, by the improvement of the people and the development of the prodigious natural resources of the country, that would be powerful for good and be no mean friend and ally—or dependency, if we must—of our own.

But the American Republic owes an enormous debt and duty to another unfortunate and simple people—a debt for services rendered in involuntary servitude, as well as for injuries inflicted upon and crimes committed against. We refer to the African negro. While we cannot compensate the dead, or even the living, for valuable labor performed as slaves, nor make amends for miseries we have caused, we can, perhaps, make a slight return by endeavoring to benefit those who remain in Africa. The descendants of the slaves living in our midst will, of course, be absorbed by the white population, and in time the race will disappear from this nation, there being now no fresh influx of pure blood. Probably nothing can be done of practical benefit toward isolating the race in America and erecting them into an empire or state by themselves, and they would scarcely accept of it if attempted. They have become affiliated with the Saxon, and absorption is their doom in defiance of state or other interference, and this result will be brought about without cruelty to or objection by them.

But we would call attention to our duty in the way of recognizing our obligations to the race, by attempting something for the good of those remaining in the mother country of the blacks. It would be a grand move for our nation to reach forth and establish civilizing protectorates over various peoples in Africa, to the end of reclaiming them from barbarism and rescuing them from the clutches of European nations now hastening to absorb them. It would be a great and philanthropic thing for our government to adopt this policy and to step in, say, in the case of the Zulus, to interfere in their behalf by protesting against their absorption and advising their liberation after conquest, except surveillance as to cruelty and education. It would be a humane departure from our habit of cold indifference to the fate of other peoples and from our selfish policy of non-interference in the affairs of the rest of the world. This policy is a studied disregard of our obligations consequent upon the possession of power and civilization. Our wealth and power mean that they are to be used for the benefit of peoples less fortunate, and imply, by their presence in our hands, our great duty to the savage and ignorant. Our policy of non-interference in the affairs of Europe is justified, perhaps, on the ground of lack of necessity. But non-interference in the affairs of weak, savage peoples, indifference to their crying woes, is not right. Our

duty to the poor African is a palpable one and should be responded to promptly; and no better opportunity could be offered, one more pregnant with possibilities for good, than that of the attack upon Zululand. Our protest would, of course, excite the resentment of England, and the question would be raised of our right to interfere. That part of the ground would need to be fought over, diplomatically, in any attempt at any time. The counter question of the right of Great Britain could then be raised, with great weight in its mere name, to the indiscriminate conquest and annexation of savage and defenseless countries. This could be seconded by our greater right to protest against her further aggrandizement in Africa, and our right to interfere in behalf of the oppressed and weak to the end of saving them from slavery and national death. We could compel her, by our protest, to show cause, and become at least resposible to other nations, for her actions.

It is strange that Turkey should be made to account and suffer for her cruelties, when England is allowed to continue her inhuman policy of the indiscriminate slaughter, conquest and enslavement of wild people. Surely, America has the right, by virtue of her principles of freedom and liberty, to interfere in behalf of the weak. The start once made, persistence in protesting against the policy of conquest by any nation, would undoubtedly bring it gradually to the approval and acceptance of all honest nations. Justice would compel England and other nations to adopt it, and a new era would dawn for weak peoples.

But our nation should inaugurate the practice of the policy by dealing—after doing our duty to the Indian and the Alaskan by way of being consistent—with those African tribes which have been most wronged by American slavery, *i. e.*, the tribes of the western coast. These people should be protected from the encroachment of European nations, and from themselves, and be developed, by the civilizing-protectorate system, into complete, civilized nationalities. The good possible to be done to the people of Central Africa, who are being swept away by the slave traffic and tribal wars, is incalculable, and the demand for immediate interference is most imperative. The appropriateness of America taking the initiative in the inauguration of this progressive and philanthropic principle with Africa's peoples, is at once apparent. We have always claimed to be the champion of the oppressed and the liberator of the enslaved. The call to the downtrodden has been sounded throughout the world, and they have flocked to our shores by millions. Our success in free government has encouraged the development of the republican principle in all nations. Liberty reigns within our borders, and the capability of civilized man for self-government is with us a demonstrated fact.

What, then, can be more appropriate than that we should go further, take another step forward, and give to the world another policy and bequeath another legacy to oppressed humanity? Our championship of it would be merely the discharge of duty, whether it originated with ourselves, or some other nation arose while we slept and stole away the honor of inaugurating it, it would yet be ours to adopt and foster the principle and apply it where conscience should dictate.

This subject is merely presented as a plea for a new national philanthrophy and the abandonment of the old national selfishness, cruelty and greed. It is merely carrying into a higher field the ordinary claims and duties of universal brotherhood. It is an appeal for national repentance for past misdeeds and for reparation for wrongs and crimes committed. It is a suggestion of the weight of the obligations under which Christian and civilized nations rest, by reason of the possession of those high distinctions. It is an attempt to promulgate the principle that nations must, by all that is good and right, begin to recognize each other's rights. It is the carrying of the principles of Christianity into international politics, and a demand for the inscription of the golden rule at the head of the code of international morals—"Whatsoever ye would that men should do unto you, do ye even so to them."

METEOROLOGY.

INTERNATIONAL METEOROLOGY.

The following extract from the *Monthly Weather Review* of the Signal Service, U. S. A., for the month of July, is published for the information of our readers as showing the rapid advance made in this country on the subject of International Meteorology, under the enlightened direction of General Myer. We hope at an early date to lay before the readers of this magazine specimens of the several maps referred to.—Ed.

World Weather Charts—*Meteorological Charts of the Northern Hemisphere.*—It has been the plan of these charts that they should be based upon observations taken simultaneously by day and at night, on land and at sea. The observations to be those of the barometer, thermometer, weather, etc., had everywhere on the globe at the same fixed instant of physical time—that is, for example, observations so arranged that those at Washington, St. Petersburg, Constantinople, etc., are taken, not at the same hours of local or clock time at those cities, for they would not then be taken at the same moment, but so arranged that the readers or observers are actually at the instruments at once, all reading and recording at one and at the same moment the readings and records are being made at every other station, and so for all places. The atmosphere over any extent of the earth can thus be viewed as a whole and at once, before any movements in it are possible. The resulting charts give a true synpsis—in effect a photograph of the atmosphere and its conditions at the instant. Such observations are known as *Simultaneous Observations*. They are characteristic of the work of this office. They were for the first time practically employed by it for purposes of prediction in 1870. Simultaneous observations as thus described are, upon the invitation of

the United States, widely taken throughout the world. They are collated at this office, printed and issued daily, forming "The International Bulletin of Meteorological Observations taken Simultaneously." The International co-operation embraces observations taken by almost every civilized power north of the equator, and observations taken at sea.

Four charts, based upon International Meteorological Observations, taken simultaneously, are issued with the July *Review*. These charts have been specially prepared. The subject of the preparation of such World Charts is referred to in the Annual Report of the Chief Signal Officer for 1878, and in preceding reports. They embrace within their limits the Northern Hemisphere.

Chart No. IV is based on the *Bulletin of International Meteorological Observations*, taken at 7:35 a. m., Washington mean time, under date of December 26, 1878, and exhibits in graphic form the barometric pressure and temperatures over the Northern Hemisphere so had for that date and hour. Lines of equal barometric pressure and equal temperature are charted, and their values are expressed in French and English measures. Extended areas of high pressures and marked barometric depressions are respectively indicated as High, Higher, Highest, and Low, Lower, Lowest. This map presents the data of the bulletin for the day charted for study. It is a map of the Northern Hemisphere, and is charted daily.

Chart No. V is based on the *Daily International Weather Charts* and *Daily Bulletin of International Meteorological Observations*, taken simultaneously for December, 1877, and shows the mean isobars, mean isotherms, mean velocity and prevailing direction of the wind at 7:35 a. m., Washington mean time (0:43 p. m., Greenwich mean time), for that month, as deduced from the simultaneous observations received at this office. The values of the lines are given in French and English measures. Isolated means, when barometric, are expressed in English inches, and when thermometric, in degrees of Fahrenheit. The chart is one of the Northern Hemisphere.

Chart No. VI is based on the *Daily International Weather Charts* and *Daily Bulletin of International Meteorological Observations* for December, 1877, and shows the movements of the *Centers of Low Barometer*, as charted from day to day for that month, and also the lines of equal precipitation (rain and melted snow), as deduced from U. S. Signal Service observations and those of co-operating international observers. Arabic numerals show the location of the center of Low Barometer at 7:35 a. m., Washington mean time (0:43 p. m., Greenwich mean time), on the day of the month having a similar number. Lines of equal rain-fall are given in both French and English measures. Isolated rain-falls, without the continuous lines, are expressed in English inches. The chart is one of the Northern Hemisphere.

Chart VII is based on International Simultaneous Observations received to date, on United States Signal Service observations and on marine and other reports received from voluntary observers. It shows the movements of the centers of the most definitely marked areas of Low Barometer of recent date. The tracks

in black have been charted in previous *Reviews* in connection with the storms of the United States, and the tracks as subsequently determined are charted in red. The subject of Ocean Storm Tracks, and the connection of them with storm tracks on land, is expressly considered in the preparation of these charts. A table of the wind velociti s accompanying the storms, both on the European and American coasts, is printed upon the chart. The chart is one of the Northern Hemisphere.

In order to satisfy the many inquiries concerning the condition, scope and progress of the labor connected with the International Simultaneous Observations, there is herewith published an extract from the Annual Report of the Chief Signal Officer to the Secretary of War, dated November 1, 1878, wherein are sufficiently set forth the origin of the work, its plan, the co-operation it has received from distinguished co-laborateurs, its progress, scope and purposes, as follows:

The proposition adopted at the congress of persons charged with meteorological duties, assembled at Vienna in 1873, and to the effect that it is desirable, with a view to their exchange, that at least one uniform observation, of such character as to be suited for the preparation of synoptic charts, be taken and recorded daily and simultaneously at as many stations as practicable throughout the world, has continued to have practical effect.

By authority of the War Department, and with the courteous co-operation of scientific men and chiefs of meteorological services representing the different countries, a record of observations taken daily, simultaneously with the observations taken throughout the United States and the adjacent islands, is exchanged semi-monthly. These reports are to cover the territorial extent of Algiers, Australasia, Austria, Belgium, Central America, China, Denmark, France, Germany, Great Britain, Greece, Greenland, Iceland, India, Italy, Japan, Mexico, Morocco, The Netherlands, Norway, Portugal, Russia, Spain, Sweden, Switzerland, Tunis, Turkey, British North America, the United States, the Azores, Malta, Mauritius, Sandwich Islands, South Africa, South America, and West Indies.

On July 1, 1875, the daily issue of a printed bulletin, exhibiting these international simultaneous reports, was commenced at this office and has been since maintained. A copy of this bulletin is furnished each co-operating observer. The results to be had from the reports thus collated are considered to be of especial importance. The bulletin combines, for the first time of which there is record, the labors of the nations in a work of this kind for their mutual benefit. There is needed only the assistance to be had from the naval forces of the different powers (that of the navies of the United States and of Portugal being, as heretofore related, already given to extend the plan of report upon the seas) to bring more fully within the scope of study observations practically extending round the Northern Hemisphere. This end is to a great extent already attained.

In this connection the office has to acknowledge the cordial and valuable co-operation of the meteorological services of the different countries, represented as follows:

Algiers, by General Teissier, Commandant Supérieur du Génie; Austria,

by Prof. Dr. Julius Hann, Director of the Imperial Royal and Central Meteorological Institute at Vienna; Belgium, by J. C. Houzeau, Director of the Royal Observatory at Brussels; Costa Rica, by Señor Frederico Maison, Director of the Central Office of Statistics and Meteorology; Denmark, by Capt. N. Hoffmeyer, Director of the Royal Danish Meteorological Institute at Copenhagen; France, by U. J. LeVerrier, Director of the Paris Observatory, Prof. E. Mascart, Director of the Central Meteorological Bureau of France, and the respective observers; Germany, by Prof. Dr. Geo. Neumayer, Director of the German Naval Observatory, Hamburg; Great Britain, by Robert H. Scott, Esq., F. R. S , Secretary of the Meteorological Council, London, Alexander Buchan, M. A., F. R. S. E., Secretary of the Scottish Meteorological Society, Edinburgh, and the respective observers; Greece, by Prof. Dr. J. F. Julius Schmidt, Director of the Royal Observatory at Athens; India, by H. F. Blanford, Meteorological Reporter to the Government of India; Italy, by the Minister of Agriculture, Industry and Commerce, and the respective observers; Japan, by the Imperial Meteorological Observatory, and the Imperial University of Tokei, Japan; Mexico, by Señor Mariano Barcena, Director of the Central Meteorological Observatory in the City of Mexico, and the respective observers; Netherlands, Prof. Buys Ballot, Director of the Royal Meteorological Institute of the Netherlands at Utrecht; Norway, by Prof. H. Mohn, Director of the Royal Norwegian Meteorological Institute at Christiana; Portugal, by J. C. de Brito Capello, Director of the Meteorological Observatory of the Infante Don Luiz at Lisbon; Russia, by Prof. H. Wild, Director of the Imperial Central Physical Observatory of Russia at St. Petersburg; Spain, by Antonio Aguilar, Director of the Royal Observatory at Madrid, and the respective observers; Sweden, by Prof. R. Rubenson, Director of the Royal Swedish Meteorological Institute at Stockholm, and Dr. H. H. Hildebrandson, Chief of the Meteorological Division of the Upsala Observatory; Switzerland, by Prof. R. Wolf, Director of the Observatory at Zurich, and Prof. E. Plantamour, Director of the Observatory at Geneva; Turkey, by A. Coumbary, Effendi, Director of the Central Observatory at Constantinople, and Prof. C. V. A. Van Dyck, Superintendent of the Lee Observatory at Beirut; Australasia, by Francis Abbott, Directory of the Meteorological Observatory, Hobart Town, Tasmania, and R. L. J. Ellery, Director of the Meteorological Observatory at Melbourne, Victoria, Australia; Canada, by Prof. G. T. Kingston, Director of the Magnetic Observatory, at Toronto, and Superintendent of the Meteorological Office of the Dominion of Canada, and the respective observers; United States Navy, by the Navy Department, through Rear Admiral Daniel Ammen and Commodore W. D. Whiting, U. S. N., Chiefs of the Bureau of Navigation, and by individual observers at other points.

The office has to regret the death, since the date of the last annual report, of four co-laborers in the work, Urbain Jean Joseph LeVerrier, Director of the Paris Observatory; Prof. Ernest Quetelet, Director of the Royal Observatory at Brussels; Prof. Edward Heis, of Münster, and Prof. Pietro Angelo Secchi, of Rome.

A number of observations taken on vessels at sea to complement the sychronous reports of the service, and at the request of the Department, have been received on the form provided for the purpose. Their utility is evident in the study of storms approaching our coasts or which endanger vessels from our ports.

The co-operation of the Navy of the United States in the taking of observations simultaneously with the system adopted at this office, wherever naval vessels of the United States may be, as assured by the general order of the Secretary of the Navy, dated December 25, 1876, has largely increased the data of this class. This co-operation has been skillfully rendered by the Navy Department and United States Navy, through the Chief of the Bureau of Navigation.

The people of the United States are thus the first nation whose army and navy co-operate, as all armies and navies should, under official orders, in the taking of simultaneous observations, wherever the forces may be.

In view of the existence of the system of simultaneous reports to be made at sea by the vessels of the naval and commercial marines of the United States and other nations, and to provide for its extension, carefully tested barometers of the best make have, since the date of the last annual report, been prepared and located, as standards, at the ports of New York and San Francisco.

These barometers have been publicly located to afford means of comparison of the ships' barometers of the shipping of all nations. The instruments, while carefully guarded, are easily accessible. Public notice is given of the location, and a Sergeant of the Signal Corps attends to give information and to take charge of any ship's barometer which may be brought for comparison.

The standard barometer for the use of shipping on the Atlantic Ocean is located at the Maritime Exchange, in New York City; the standard barometer for the use of shipping on the Pacific Ocean is located at the Merchants' Exchange, in the city of San Francisco

The officers of the Signal Service at the different cities and ports of the United States and upon the sea coast offer every facility and aid within their power to the vessels of any nation.

With the plans for charting now adopted at this office, and with the reports now received here, it appears that the meteoric changes occurring over a great portion of the continents north of the equator can be charted with an accuracy sufficient to permit careful and valuable study. This charting, to be of the best attainable value, must be supplemented from the records of observations had on the seas. A ship at sea becomes one of the best of stations for a simultaneous system. The value of the record is enhanced by the change of the ship's location occurring within each of the twenty-four hours. There is no sea-going vessel but that carries human life, and each ought to carry, by compulsion, if need be, meteorological instruments. The smallest craft, in caring for its own safety, may use them enough to add to the value of the most extensive record. There is no nation without interest in the work proposed to be based upon exchanged simul-

taneous reports, and none has hitherto hesitated, when the subject has been properly presented, to aid in a duty which, so easily done as to require very little effort on the part of any one person, has for its object a good to mankind. The work cannot, from its nature, be for the selfish good of any section.

A number of the great steamship companies, foreign and domestic, operating the principal commercial sea routes, have promised and will give their powerful influence and aid.

The office has the co-operation of the Pacific Mail Steamship Company, through its agents, Williams, Blanchard & Co.; the White Star Line, through its agents, Ismay, Imrie & Co., Liverpool, and R. J. Curtis, New York; the Occidental and Oriental Steamship Company, through its President, George H. Bradbury; the North German Lloyd, through its agents, A. Schumacher & Co.; the American Steamship Company, through its President, H. D. Welsh; the Red Star Line, through its President, James A. Wright; and the Allen Line, through its agents, A. Schumacher & Co.

The United States bear, in the cases of all maritime observers co-operating in this system, all expenses for forms, postages, etc., when so desired, and not infrequently, and, when necessary, loan the required instruments.

The number of observations made daily on separate vessels at sea is one hundred.

Even if predictions are not directly practicable, research has already gone far enough to indicate the paths through which to learn what sequences will be found on our own western coasts, consequent on conditions reported as existing on or near the eastern coast of Asia or on the Pacific Ocean.

Similar studies will have reference to our own southern and eastern coasts and to the western coast of the European Continent. The time cannot be far distant when vessels leaving any Atlantic port may be informed whether any notable disturbances exist at sea, and where it is likely to threaten the voyage.

The establishment of permanent ocean stations in lines traversing the oceans over or near the telegraphic cables, and in telegraphic communication with either continent, is not considered impracticable, and has been referred to in a preceding report.

There is reason to hope that a progress has been made which will eliminate from the study of practical international meteorology some of the difficulties hitherto encountered.

There are grounds to hope, also, that the atmospheric conditions and changes of condition can be charted with sufficient accuracy over any extent of the earth's surface. If the hope has fruition, meteorological barriers will, as against study, practically cease to exist.

While the stations are crowded in some localities, each is useful—each serving to check the work of the other, and each aiding to close the gaps the failure of the others might sometimes cause. The work is not likely to be abandoned by those in the different countries who have taken part in establishing it, and who

share its benefits. If it served no other purpose than to maintain, as it does, the pleasant co-operation of those charged with the meteorological duties of the different countries, it would be of value. It is hoped that, by systems of observations thus extensive, generalizations may be had to permit the announcement of meteoric changes for periods longer in advance than have been hitherto practicable.

The average number of daily simultaneous observations now made in foreign countries is two hundred and ninety-three. The total number of stations on land and on vessels at sea from which reports are entered in the bulletin regularly, is five hundred and fifty-seven. The co-operation of the different nations, secured by this plan of exchange, as above described, renders the additional cost to the United States, of the grand system of reports it makes possible, but little more than that of the cost of the preparation, paper, and binding of the International Bulletin and the accompanying charts, a cost which would have to be met in great part for the proper preservation of the records themselves, even if the bulletins were not distributed.

The Chief Signal Officer is gratified to announce in his report that the work of the collection of the reports of International Simultaneous Observations, carried on in foreign countries in co-operation with the United States, as well as within the Territories of the United States and upon the seas, thus above referred to, has, in the year just passed, so far progressed as to have attained one principal result for which it was set on foot. On July 1, 1878, it became possible, for the first time in the history of this office, to commence the issue, on that date, of a daily international weather map, charted daily and issued daily, each chart based upon the data appearing upon the International Bulletin of Simultaneous Reports of similar date. The charting extends around the world, and embraces for its area the whole Northern Hemisphere.

The daily issue of a chart of this kind, thus daily issued for the first time by the United States, is without a precedent in history. It exhibits the co-operation, for a single purpose, of the civilized powers of the world north of the equator.

The studies of such charts make possible the improvement which will come as the work progresses and the area of the chart is better filled with reports of observations carefully elaborated. and they are fully appreciated by scientific men.

The questions as to the translations of storms from continent to continent, and of the times and directions they may take in such movements; the movement of areas of high and of low barometer; the conditions of temperature, pressure and wind-direction existing around the earth at a fixed instant of time, permitting thus the effects of day and night to be contrasted; the distribution and amount of rainfall, and other studies, many and valuable, only suggested by this enumeration, may be by such studies settled. It seems not impossible that in the future questions of climatology, and perhaps others bearing upon the prediction of weather changes far in advance of the time at which these changes may happen, or questions of the character of coming seasons even, may be answered by the researches these charts will make practicable.

The very great aid and material furnished in this elaborated form gives to the search for generalization, or for data in the support of theories, was referred to in the last annual report. In frequent cases little more than collation is necessary.

As a means of better combining the work and the interests of the several nations; of certainly securing that co-operation at sea which will enable the lines of the charting to be drawn as fully and as well over oceans as ov r continents; and which will give the world ultimately a knowledge as practical of the movement of areas of disturbance in the midst of the seas as is now had of such movements on some continents, the undertaking is of much importance.

It is an advantage of the charting draughted from simultaneous reports that studies by normals, not possible in any other way, can be made. The normal pressure, temperature, &c., arrived at from observations taken at any one place, at the same and a fixed instant of time every day, become established as to that place and time with accuracy.

Many causes of error are eliminated.

The inter-comparison of these normals with the normals taken at other places simultaneously with the first and under the similar condition that the normals to be found by those places are to be from observations taken at those places at a fixed time and on every day, gives results reliable, and differing from those to be had by the use of normal readings arrived at in any other manner. Normals for the year, for the season, and for the month may be determined by such procedure. The comparison of such normals will show in the case of abnormal changes in any district or section, for any season, whether and how they are compensated by compensating variations elsewhere. There are interesting studies as to what sequences there may be to follow such atmospheric variations occurring over any region or country—either in that region or country or elsewhere—and how and where the compensating variations occur, and with what concomitants or sequences of meteoric changes.

There is the hope to gain in this way, or by investigations which such study will suggest, information to benefit the commercial and agricultural interests of the world.

There is the further hope that as it is more fully realized by the different peoples, how close in the future the practice of such investigations draws, each member of the family of nations will find its own interests in labors of this description, and draw more closely the bonds and join with energy in a work which has so begun to connect them. The undertaking, world-wide in extent, is capable of rendering a world-wide benefit."

Maps based upon a single simultaneous observation, taken daily, demonstrate what may be expected when more frequent observations are attainable, and the daily period of twenty-four hours may be exactly divided by the intervals at which such observations are taken.

It is by the study of charts of the character of those herewith described and referred to, the practical solutions of the great questions of Ocean and Continental Meteorology, and possibly some prevision of seasons, may be hoped to be arrived at.

LAWS OF ATMOSPHERIC ELECTRICITY.

Atmospheric electricity presents daily in Piedmont two maxima following the rising and setting of the sun, at an interval of some hours. These two maxima are separated by a minimum which follows the passage of the sun over the meridian of the place. As regards the annual fluctuation, the maximum value of the atmospheric tension falls in February, and the minimum in September. Before and after storms the electrometer always marks zero, but during their passage or proximity the tension is very great. Rain and snow increase tension more slightly, and are often preceded and followed by electric diminution. The action of fogs, hoar frosts, and of the formation of clouds increases atmospheric electricity, though to a less extent than that of rain and snow. In calm and hot weather the lowest values are observed. South, and especially southeasterly, winds increase the electricity of the air; north winds have an opposite effect. Rain and snow are accompanied by negative electricity, at least as often as by positive. The same proportion holds good for storms and to a less extent for rain and snow. Negative electricity is generally due to storms or rain at a distance, to the formation of clouds, or to a polar aurora. In the normal conditions of the atmosphere electric tension decreases with altitude.—*P. F. Denza.*

METEOROLOGICAL IDIOSYNCRASY OF THE AMAZON BASIN.

EDWIN R. HEATH, A. M., M. D., SAN ANTONIO, BRAZIL.

The determination of elevations above the sea, by means of instruments which measure atmospheric pressure, has of late years become one of the many duties of a scientific traveler.

The accuracy of Barometrical and boiling point Thermometrical leveling, compared with known levels, has justly raised it to a scientific branch. However reliable it may be generally, an exception must be made, at present, with regard to that part of South America from the foot of the eastern slope of the Andine chain eastward, comprising all the country drained by the Amazon River and its tributaries.

Here, elevations given by reliable travelers vary (for the same place), from 250 feet below sea level to 1475 feet above. Prof. Agassiz says: "The barometer cannot be depended upon to determine elevations on the Amazon." A fact so at variance with other places proves either want of accuracy in our instruments or a need of more careful observations by travelers. For six months we have made a speciality of the atmospheric changes; monthly records of which have been forwarded to the Smithsonian. A summary of these is included in this article, also in tabular form the elevations of various places on the Amazon and river Madeira, with Barometric or Thermometric readings from which the elevations were obtained, the traveler's name and date of observations.

LOCALITY.	ALTIT'.	MERC. BAR.	ANEROID.	BOIL'G P'T THERM.	OBSERVER.	
Mouth of River Napo .	385	29.526		211.4°	James Orton.	River Amazon.
Nauta	365				Castleman.	
	345	29.510		211.1°	J. Orton.	
Pebas	537			211.1°	Herndon.	
Loreto	345			211.4°	J. Orton.	
San Antonio	256	29.655				
	255	29.656		211.5°	J. Orton.	
	670				Spix and Martius.	
	150				Azevedo and Pinto	
Tabatinga	200				Agassiz.	
	138	29.770			J. Orton.	
Tunantins	124				Azevedo and Pinto	
	100	29.813		211.9°	J. Orton.	
	2052			208.2°	Herndon.	
Ega	120				Azevedo and Pinto	
	199	29.705			J. Orton.	Negro.
Barra or Mundos on the River Negro .	1475			209.3°	Herndon.	
	293				Castelnau.	
	556				Spix and Martius.	
	92				Azevedo and Pinto	
	−253			212.5°	Wallace.	River Amazon.
Mouth of River Madeira	442.83			210.87°	Gibbon.	
	69		30.930		Keller.	
	158	29.752			J. Orton.	
	84				Azevedo and Pinto	
Serpa	59		30.+		Keller.	
	114	29.802			J. Orton.	
	58				Azevedo and Pinto	
Obidos.	45				Agassiz.	
	107	29.808		211.5°	J. Orton.	
	846			210.5°	Herndon.	
Santarem	50				Azevedo and Pinto	
Mont Alegre	83	29.834			J. Orton.	
	38	29.890			"	
Gurupà	42				Azevedo and Pinto	
	15	29.889		211.95°	J. Orton.	
		29 914			J. O. reduced to level of River.	
	320	29.708		211.5°	Herndon.	
	35				Azevedo and Pinto	
Parà.	35	29.977			Dewey.	
Atlantic Ocean . . .	−2	29.932		212.16°	J. Orton.	
Borba	442.8			210.87°	Gibbon.	River Madeira.
Manicorè	92				Keller.	
Bætas	131				"	
Tras Casas	164				"	
Ilhado Salemaò . . .	174		Keller.		"	
Domingo Leigue . .	177				"	
Mouth River Jammary	184				"	
Is. Tamandua. . . .	442.8			210.87°	Gibbon.	
Rapids San Antonio . .	200				Keller.	
" " " .	750	29.150			Heath, mean of 3 mos.	

SAN ANTONIO, RIVER MADEIRA, BRAZIL, S. A., FEBRUARY, 1879.

Date.	Height of Water in the River.	Rainfall.	Thermometer.		Weather.				7 A. M.		12 M.		6 P. M.		9 P. M.	
			Max.	Min.	7	12	6	9	Merc. Bar.	Ther.	Merc. Bar.	Ther	Merc. Bar.	Ther.	Merc. Bar.	Ther.
1	. . .	.180	80	72	R	R	C	C	29.162	76	29.131	82	29.120	78	29.122	78
2	. . .	.080	90	72	C	C	C	R	29.020	76½	29.114	87	29.000	83	29.100	79
3	170.360	.070	91	72	C	C	C	C	29.191	76	29.121	91	28.962	88½	29.084	79½
4	. . .	. .	92	72	C	C	C	C	29.172	77	29.062	91	28.994	88	29.082	83
5	. . .	.450	94	74	O	C	C	C	29.133	78	29.023	88	28.920	87	29.002	82
6	169.365	.340	90	73	C	P	C	C	29.131	77	29.040	89	28.991	82	29.024	80
7	. . .	.050	90	72	C	C	C	C	29.150	77	29.024	91	29.023	82	29.084	78
8	. . .	.645	84	73	C	P R	R	C	29.131	78	29.071	83	29.082	77	29.113	77
9	. . .	.865	88	72	O	C P	C P	R	29.154	76	29.062	87	29.004	86	29.101	79
10	172.725	.040	88	72	R	C	C P	C	29.222	75	29.131	87	29.070	80	29.152	78
11	. . .	.010	86	74	C P	O	C	C	29.184	76	29.141	84	29.001	89	29.131	80
12	. . .	.410	88	74	C	C	C	C	29.141	77	29.112	89	28.964	87	29.092	81
13	172.990	.230	88	74	C	O	R	C	29.142	76	29.120	86	29.003	84	29 103	79
14	. . .	.460	93	74	C F	C	C	C P	29.152	78	29.121	86	28.983	88	29.070	83
15	. . .	.030	88	74	R	R	C	O	29.200	76	29.200	78	29.071	80	29.113	77
16	. . .	.070	85	70	O	C	C	C	29.164	75	29 022	89	29.071	80	29.044	80
17	178.465	.380	86	71	C F	R	C	C	29.141	77	29.120	84	28.993	86	29.042	81
18	. . .	. .	88	73	C	R	B	B	29.174	77	29.161	86	28.992	86	29.102	79
19	. . .	.625	91	74	C	C	O	O	29.163	77	29.131	87	29.011	88	29.074	83
20	179.209	.880	92	72	O	O	O	O	29.162	78	29.141	85	29.071	78	29.140	77
21	. . .	. .	86	72	O	B	O	R	29.200	75	29.162	82	29.056	83	29.113	79
22	. . .	2.100	85	70	O	O	O	O	29.212	76	29.192	84	29.140	77	29.152	76
23	. . .	.190	88	72	O	C	B	B	29.250	77	29.100	89	29.094	85	29.140	80
24	180.134	. . .	84	72	C	C	O P	O	29 190	74	29.122	81	29.080	83	29.083	77
25	. . .	. . .	88	72	O	R	O	O	29.154	75	29.103	88	28.941	86	29.092	81
26	. . .	. . .	92	74	C	R	O	O	29.090	75	29.074	90	29.012	85	29.064	82
27	. . .	1 010	86	74	C	C	R	R	29.090	78	29.103	79	28.993	84	29.050	80
28	180.404	1.130	88	74	C	C	R	R	29.084	77	29.052	88	29.043	82	29.101	78

METEOROLOGICAL OBSERVATIONS MADE AT SAN ANTONIO, (RIVER MADEIRA) BRAZIL, S. A., FOR MAY, 1879, BY E. R. HEATH, A. M., M. D.

DATE	HEIGHT OF WATER IN THE RIVER.	RAINFALL.	THERMOM'R.		WIND								WEATHER.				ANEROID IN FEET.				7 A. M.		12 M.		6 P. M.		9 P. M.	
			Max.	Min.	Direction. 7	12	6	9	Force. 7	12	6	9	7	12	6	9	7	12	6	9	Mer. Bar.	Th.	Mer. Bar	Th.	Mer. Bar	Th.	Mer. Bar.	Th.
1	175.724	. .	88	71	O	SS E	O	O	o	5	o	o	O	C	B C	B	1100	1150	1095	1110	29.273	75	29.231	86	29.174	83	29.240	77
2	. . .	. .	91	70	S	SE	O	O	o	2	4	o	B C	C	C	C	1110	1110	1100	1150	29.263	73	29.251	85	29.172	85	29.214	78
3	. . .	. .	94	72	O	S	O	O	o	o	2	o	B C	B C	C	C	1130	1120	1210	1150	29.260	72	29.241	86	29.173	84	29.204	78
4	. . .	.010	91	73	O	E	O	O	o	1	o	o	C	C	C	C	1150	1165	1250	1200	29.253	72	29.212	88	29.134	83	29.163	79
5	172.979	. .	91	71	O	NE	O	O	o	1	o	o	O	C	C	C B	1175	1175	1250	1200	29.220	77	29.210	87	29.133	83	29.170	77
6	. . .	. .	91	73	O	E	SE	SE	o	3	3	1	B	C	P	C	1175	1175	1250	1125	29.211	73	29.252	89	29.140	85	29.224	78
7	. . .	.296	91	73	O	S	O	E	o	3	o	1	C O	C	O	P	1150	1200	1225	1150	29.204	76	29.181	91	29.132	82	29.180	79
8	172.349	. .	89	69	O	SE	S	O	o	4	1	o	O	C	B C	B C	1150	1125	1110	1175	29.252	75	29.221	87	29.164	83	29.210	78
9	. . .	. .	90	67	O	SE	SE	O	o	4	1	o	B	B	B	B	1110	1075	1150	1100	29.280	72	29.281	86	29.201	82	29.253	77
10	. . .	. .	91	71	O	SW	SW	O	o	2	1	o	B	B C	B	B	1100	1090	1175	1150	29.302	68	29 291	86	29.203	82	29.241	76
11	. . .	.358	91	71	O	N	O	O	o	2	o	o	O C	P	O	C B	1110	1110	1170	1110	29.282	74	28.250	85	29.203	79	29.253	78
12	169.479	.189	91	73	O	N	O	O	o	2	o	o	F	C	P	O	1100	1140	1150	1100	29.290	75	29.232	90	29.210	84	29.261	79
13	. . .	. .	88	68	O	E	O	O	o	2	o	o	O	P	B	B	1090	1075	1150	1110	29.284	75	29.300	87	29.254	83	29.230	78
14	. . .	. .	90	66	O	E	E	O	o	2	1	o	B	B C	B	B	1075	1100	1150	1110	29.330	70	29.274	88	29.244	82	29.251	75
15	170.414	. .	85	69	O	E	E	O	o	3	1	o	P	B	B	B	1090	1090	1190	1150	29.322	67	29.270	88	29.191	84	29.240	74
16	. . .	. .	85	72	O	E	E	S	o	1	1	1	B C	O	B C	C R	1075	1050	1150	1075	29.311	72	29.322	87	29.240	83	29.260	78
17	. . .	.064	90	70	O	W	O	O	o	2	o	o	B	P	C	B C	1100	1090	1125	1095	29.291	74	29.292	88	29.244	79	29.293	74
18	. . .	. .	86	72	O	E	E	E	o	6	1	1	C	P	O	C	1090	1100	1175	1110	29.301	73	29.274	86	29.191	80	29.233	75
19	167.439	.006	88	72	O	W	W	O	o	1	1	o	O	C	C	O	1100	1100	1175	1120	29.290	74	29.264	88	29.200	80	29.250	78
20	. . .	. .	91	72	E	W	W	O	1	3	1	o	P	C	C	B	1120	1110	1220	1150	29.260	75	29 251	89	29.160	83	29.223	79
21	. . .	.050	90	71	O	W	O	O	o	2	o	o	C	P	C	B C	1150	1175	1205	1150	29.262	75	29.200	88	29.164	78	29.222	75
22	164.889	.002	90	72	E	E	O	O	1	3	o	o	F	B	B	B	1175	1190	1270	1225	29 240	73	29.220	87	29.121	83	29.161	78
23	. . .	.065	87	72	O	W	W	O	o	3	1	o	C	P	C	C	1160	1200	1250	1200	29.222	75	29.184	90	29.140	82	29.174	78
24	. . .	. .	89	70	O	W	O	O	o	1	o	o	F	O	O	O	1150	1150	125	1150	29.260	75	29.230	86	29.133	82	29.204	79
25	. . .	. .	80	72	E	E	E	E	3	5	2	1	O	C	O	O	1120	1110	1200	1110	29.263	72	29.263	84	29.184	79	29.231	76
26	162.559	. .	84	59	O	E	E	E	o	4	3	.8	C	C	C	O	1100	1075	1020	1000	29.312	75	29.314	82	29.293	76	29.384	71
27	. . .	. .	82	60	E	E	E	E	1	3	1	1	C	B	C	O	950	975	1000	950	29.505	62	29.451	76	29 281	76	29.500	72
28	. . .	. .	82	60	E	E	E	E	1	4	1	1	B	B	B	B	990	1000	1050	1050	29.463	67	29.462	79	29.320	75	29.374	68
29	160.935	. .	86	62	E	E	E	E	1	1	1	1	B	B	B	B	1090	1125	1125	1110	29.432	60	29.290	82	29.270	73	29.320	68
30	. . .	. .	88	62	E	E	E	E	1	1	1	1	B	B	B	B	1025	1035	1075	1050	29.431	60	29.360	83	29.313	77	29.343	72
21	. . .	. .	83	63	E	SE	E	E	1	3	1	1	B	B	B	C	975	990	1050	1025	29.471	60	29.410	80	29.353	77	29.384	73

Orton and Keller made their observations in 1867, (Orton with a Mercurial Mountain Barometer graduated to 10,000 feet; Keller with two Aneroid Barometers). Castelman in 1846; Spix and Martins in 1820; Azevedo and Pinto from 1862 to 1864; Wallace 1848 to 1857; Herndon and Gibbon in 1852, (with Mercurial Mountain Barometers). Gibbons' boiling point was the same for all points on the Madeira river below the rapids of San Antonio and at Manavo, showing a uniform pressure of the atmosphere for a distance of 670 miles and over, and from October 3rd to 25th *i. e.*, twenty-two days. Unfortunately we have no record of the barometer or thermometer by Castelman, Azevedo and Pinto, or Spix and Martins, only the recorded elevations.

Keller was a German civil engineer in the employ of the Brazilian Government, and sent to explore the river Madeira. The records for February and May, 1879, which I inclose of observations made by myself, speak for themselves, and are made with great exactness and with reliable instruments. San Antonio is on the river Madeira 560 miles above its mouth, in south latitude 8° 48′ 14″, longitude west of Greenwich 63° 55′ 05″, compass variations 5° 56′ E.

We have shown the months of February and May since they were the months in which the barometer was the lowest and the highest, February marking 28.9 inehes and May 29.5 inches. From February to June inclusive the mean barometric reading was increasing from 28.9 to 29, 29.1, 29.2, 29.3, June being rather over 3 tenths than under. From these notes one can readily see the discrepancy that would arise from observations made by travelers happening to arrive here at these different months. The aneroid barometer from which the observations in feet are recorded in the May report is a costlv one, and proved many times on the railroads in Peru, always reading within fifty feet of known levels on going from the coast to elevations 16,000 and 18,000 feet and returning. The mercurial barometer with thermometer attached is a mountain barometer, capacity of 10,000 feet elevation, and known as Smithsonian B, made by James Green, New York City, (No. 1608). The weather and wind symbols are after Bowditch. During the months of February, March and April the wind varied in direction and force according to local causes and passing showers, there being no time one could say it had a determinate direction. May 1 the wind took a steady course for a number of days, that is we had a regular breeze which did not depend on local causes.

Before May the atmospheric pressure remained the same before, during and after the passage of a shower, although accompanied by a sharp blow, a dead calm both preceding and following the shower; but no sooner did the May breeze spring up than the barometer showed the change in atmospheric pressure, as it increased or decreased in force. As a rule the nights are so calm that observations can be made with the artificial horizon uncovered without the least particle of motion of the mercury.

The country is nearly level and covered with a dense tropical forest which covers it to the depth of 200 feet and over. Light and air seldom penetrate this covering, so that motions of air above the tree tops would be little felt on the

ground beneath. The river-bed is generally from twenty to fifty feet still lower, and it is from the river-level most calculations of elevations are made. But at this point the ground is hilly and clearer, so that currents of air can reach all parts, although in eddies. The river rises and falls from forty-five to fifty feet although over a mile in width. It reached its highest point this year March 13th.

We present below in tabular form the amount of rainfall, number of days in which rain fell, mean of the maximum and minimum thermometers, and highest and lowest point reached by the thermometer at this place during the first six months of the year 1879.

MONTH	RAIN FALL	No. days Rain Fall.	THERMOMETER. Highest	THERMOMETER. Lowest	THERMOMETOR. Mean Max	THERMOMETOR. Mean Min
January	15.000 in.	23	97°	70°	87.966°	72.666°
February	10.245	22	94	70	88.150	72.571
March	16.412	24	94	70	87.903	71.903
April	11.399	21	94	68	88.440	72.100
May	1.040	9	94	59	88.161	68.999
June	2.315	5	93	62	90.033	69.233

The height of the water in the river in February and May reports is calculated from station zero of the Madeira and Marmoré railroad, assuming it to be 200 feet above sea level. From 8 A. M. to 4 P. M. the thermometer generally ranges from 86° to 94°, and days in which the air is a perfect calm the heat is very oppressive, prostrating one's energy, and planting seeds of biliousness, bilious remitting fevers, agues and jaundice. One peculiar effect is to make the nervous system excessively acute, so that every one passes the night as if under the effects of a strong cup of tea or coffee, making the bladder very irritable, inflaming the kidneys and prostate gland, irritating the stomach so that many die from vomiting. The mortality on the river from bilious remitting fevers and pleuro-pneumonia has been heavy except at San Antonio. Cramps in the calves of the legs, paralysis, neuralgia and rheumatism, and ring-worms are universal. Vampire bats and mosquitoes by night and sand flies, ants, wasps, sweat bees, and a minute red mite are the pests to man presented by the climate and vegetation, while mold destroys everything during the rainy season. There are two kinds of sand-fly, the Pium and Maruim, as they are called here, while the mite which is microscopic before and red after being gorged with blood, is called Mucuim. In so short a time it is impossible to collect information which would be exhaustive. The May and February records will show the general daily variation of the atmosphere. We hope in the future to present data sufficient to assist in placing the barometer in its rightful position of "leveler" even in the tropics.

THE NOVEMBER METEORIC SHOWERS.

PROF. J. H. TICE.

A few days after the occurrence of the great meteoric shower on the night of the 27th of November, 1872, I published a theory of the cause of these phenomena, and stated that on the 8th of September, 1879, the astronomical event to

which I attributed them would occur within eight hours and twenty minutes of the time it did in 1833, which was followed by the memorable meteoric shower of November 13, in that year. Should the brilliant shower be repeated on the morning of the 13th of November next, it must be accepted as a verification of the theory.

At the same time I pointed out that another, a similar astronomical event, would occur on the 9th of November, 1879, which would cause meteors on the 7th and 8th of December following. The meteoric display of December is never so brilliant as those of November. They at times appear as early as December 6, and at others continue as late as December 10.

The expected meteoric shower of the 13th of November next is noted in my almanac of the current year in the forecasts of the weather. It can not appear until after 1 o'clock a. m., when the constellation Leo rises toward which the earth on her orbit is then flying. It is to be hoped that the sky may be clear, that a good view of the spectacle may be had.

The brilliant meteoric shower that occurs on the 13th of November is repeatedly recorded in ancient and modern history, especially by the Arabs, who lived under a less cloudy sky in Arabia, Egypt, Morocco and Spain than the people of Northern Europe do. These showers inspired awe, amazement, fear and consternation wherever witnessed, because the people believed them ominous of an impending calamity.

The brilliant shower that occurred on the night of the 27th of November, 1872, was not observed in the United States, because on that night the Continent generally was covered by a cloud, and where the sky was not cloudy the signal officers report it either as smoky or hazy. It was, however, generally observed in Europe, where the sky was clear, and on board of ships on the Atlantic, and from Greenland to Brazil.

ASTRONOMY.

THE RUSSIAN ASTRONOMER, M. OTTO STRUVE.

PROF. ORMOND STONE.

M. Otto Struve, the Director of the Imperial Observatory of Russia, is now a man sixty years of age, and his whole life, as one may say, has been passed in the midst of astronomical labors. His father was the Director of the Imperial Observatory, then located at Dorpat. It was there that the present Director was born, on May 7, 1819. The elder Struve distinguished himself at Dorpat by his indefatigable labors in the discovery of double stars. In the year 1839 Otto became Assistant at the Poulkova Observatory, upon the removal of his father to that place, and in 1862, his father having become disabled by reason of age, he

was promoted to the full control of the observatory. In 1864, upon the death of his father, he was appointed Director.

In addition to his labors as an astronomer, he has devoted much time to geodesy. As a member of the general staff he has had charge of the surveys which have been made of recent years throughout Russia. In 1845 he published a catalogue of 500 double stars which he had discovered. The "Mensuræ Micrometricæ" of the elder Struve contained the results of a survey of all the northern heavens. The work of the present Director has been supplementary to this general survey. Recently he published a work, the result of forty years' labor, which contains about 10,000 observations. While carrying on the work of looking for double stars, he has given special attention to the observing of binary stars—that is, of those double stars which are found to have an orbital motion. Among his other publications are papers on the satellites of the planet Uranus, determinations of parallax, on the nebulæ, especially those in the constellation Orion, and a new determination of the constant of precession. M. Struve was the first astronomer to compute directly the motion of the solar system in space.

In an interesting paper included among the publications of the Smithsonian Institution for 1867, Cleveland Abbe, formerly Director of the Observatory of Cincinnati, has given an entertaining description of the Imperial Observatory of Russia and its surroundings at Poulkova. Directly south of St. Petersburg, along the line of the great military road from the capital to Warsaw, the wide plain which stretches away from the mouth of the river Neva is broken by a hill of moderate elevation. Both Peter the Great and Catherine the Empress appropriated this spot as a pleasure garden. The road to Warsaw half encircles the hill. On the northeastern slope is situated a small village of the peasantry which has given a name both to the mountain and to the observatory. "On the northeastern outskirts of the village," writes Mr. Abbe, "and not a mile distant from the observatory, we find a favorable spot whence we behold at once the full beauty of the observatory hill. Looking to the southwest we see at first only the log houses and fruit gardens of the villagers, while beyond a wild forest covers the mountain. But a more careful scrutiny converts the forest into a semi-artificial grove, 'The Little Switzerland' of the Poulkovites, covering the abrupt northern slope of the declivity. The curving and ascending Warsaw road bounds our diminutive forest on the side nearer to us. On the roadside, nestling among the green trees of the observatory park, is a white arched porch, covering a far-famed spring. A little further up, and to the left, is the dwelling of the former observatory mechanician, while very far behind it one sees the tall geodetic signal. Behind the grove peeps out the tasteful little observatory of the officers of the military academy. Thence the green lawn spreads out in front of the imperial observatory, whose three turreted domes crown the hill. These three domes, even from a great distance, are noticeable features in the landscape. Let us leave St. Petersburg by the broad Tsarkoe-Selo avenue, and long before entering the Warsaw road, even before passing under the triumphal arch, if we look directly south we may see be-

tween its pillars the long, straight road, the Poulkova hill, and the domes ten miles distant. The middle and largest dome appears connected with the macadamized road by a narrow line, but our swift troika soon brings us near enough to perceive that the line is a footpath leading straight up the hill, dividing the green forest of our little Switzerland into equal portions on the right and on the left. Only the monotony of the surrounding plains can justify our comparison with Alpine scenery, as we readily acknowledge when, having ascended to the topmost step of the footpath, we learn that the village behind is scarcely one hundred feet below us. Behind us is the long road with its double row of lindens, and St. Petersburg in the distance; before us is a grassy lawn of ten acres, and beyond that the observatory. Our path leads without turning, straight through an avenue of lindens and between fragrant flower beds up to the doric columns of the vestibule. A shaded path on the left takes us behind ancient elms to the observatory of the military academy. One to the right brings us through a grove of changing evergreens to the Peter's stone and the tall signal.

"The Russian architects well understand the use of colors in relieving the monotony of a wintry, snow-covered landscape. We have before us on either hand the deep-red brick dwellings flanked by evergreens and birches and inclosing the observatory, whose brown woodwork and cream colored stucco, resting upon light sandstone foundations, contrast as beautifully with January's snows as with the fresh green of June. One should visit Peter's stone and the quiet graveyard, and linger in this beautiful park before entering the observatory. Under the noble elms the peasants spend many a summer holiday; here travelers stop to rest and lunch, and enjoy the view, and of a pleasant afternoon the observatory families may be seen dining and chatting over coffee or tea, all enjoying the luxury of that open air life that Europeans, and especially the Germans, indulge in so heartily."

The object of M. Struve's visit to this country, as previously stated, was to find out whether the gigantic telescope, which it is proposed to erect at Poulkova, could better be constructed in the United States than in Europe. He examined the observatories at Washington and Cambridge, and afterward visited the manufactory of Alvan Clark & Sons. Afterward he was present at some of the sessions of the American Association for the Advancement of Science at Saratoga, and from the remarks which he made there it may be fairly inferred that he has decided to have the great telescope built in this country. Upon leaving Saratoga he visited Niagara Falls. After visiting Cincinnati he returned at once to New York, and sailed September 10th for Europe. He was accompanied by his son, Hermann Struve.

THE CINCINNATI OBSERVATORY.

The Cincinnati Observatory had its origin in a course of astronomical lectures delivered by Professor O. M. Mitchel, in the spring of 1842, at the hall of the Cincinnati College. At the close of this series Prof. Mitchel presented a plan for

procuring funds with which to found an astronomical observatory, and this plan was carried into immediate execution. A refracting telescope was purchased in Munich, of the German instrument makers Merz & Mahler, at a total cost of nearly $10,000. Four acres of land, occupying a commanding position east of the city, was presented by a wealthy citizen, Mr. Nicholas Longworth. On the 9th of November, 1843, the corner-stone of the observatory was laid, with appropriate ceremonies, by the venerable John Quincy Adams, and in the spring of 1845 the telescope of eleven inches aperture was mounted upon its pier. No sooner had the observatory been completed than a fire destroyed the Cincinnati College, and as no financial means had been provided for the maintenance of the observatory, Prof. Mitchel was compelled to resort to the delivery of popular lectures in order to gain a support. Although these duties left him but little time for scientific investigation, he struggled bravely on, until, in 1859, he removed to Albany to assume control of the Dudley Observatory. Two years later, upon the breaking out of the rebellion, he entered the military service, and after a short but brilliant career lost his life as the result of exposure to the hardships of the field. The value of Prof. Mitchel's work cannot be overestimated. Besides his observations and the invention of the chronograph, he accomplished a valuable work in arousing public interest in astronomy by his lectures, which were marked by great clearness of thought, vividness of imagination and beauty of diction.

For the next few years after Mitchel's death the institution remained practically dormant, until, in 1869, Prof. Cleveland Abbe assumed charge, his salary having been guaranteed by a number of the liberal citizens of Cincinnati. A comprehensive plan of observations was immediately inaugurated. The smoke from the city, which had now grown until it quite surrounded the observatory, interfered very materially with Prof. Abbe's labors, and he was compelled to devote a large portion of his time to meteorology. In fact, his administration is rendered memorable by the services of daily weather reports which he inaugurated, from which afterward sprung the system now employed by the United States Signal Service, and by his efforts looking toward the permanent establishment of the observatory in a more eligible location. As a result of these efforts, an agreement was entered into in 1870 between Mr. Longworth's heirs, the Astronomical Society and the city, by which the sale of the old site was permitted and the city pledged to maintain the Observatory in connection with the University. As a part of this plan, Mr. John Kilgour donated $10,000 for building purposes and a magnificent site of four acres of land at Mount Lookout, about six miles east of the city. The observatory was completed in 1874, and in the spring of the following year Prof. Ormond Stone, of the Naval Observatory at Washington, was elected Director, and entered at once upon the duties of his office.

The position now occupied is probably more suitable for astronomical purposes than any other which could have been obtained in Hamilton County. It is free from the smoke and heated air of the city, and the horizon is unobstructed in every direction. The building is 71 feet by 48 feet, with 47 feet elevation. It is

built of brick, trimmed with freestone, and consists of a central portion surmounted by a revolving turret dome and flanked by two wings, one for a meridian instrument and the other for a library and director's room. The principal instrument is the eleven-inch equatorial, originally mounted in 1845 at the old observatory on Mount Adams. It is mounted in the turret upon an iron pedestal which rests upon a solid brick pier. Its object glass has been refigured by Alvan Clark & Sons, and a new driving clock added. The library contains nearly 2,000 volumes, almost wholly collected by the present director. Besides the equatorial and the library, the observatory possesses a valuable collection of subsidiary instruments, including a four-inch Clark refractor, a three-inch Buff & Berger transit, chronograph, clocks, telegraphic apparatus, etc.

The obligations of the city have been promptly met, and in order to secure the income necessary to carry out these obligations, the Legislature of Ohio has directed the School Board of Cincinnati to levy a tax each year upon the city of not less than three nor more than five hundredths of a mill. This levy now yields something over $5,000 per annum, an income by no means large; but still if it is faithfully and economically employed, and the results obtained promptly published, there is reason to believe that an enviable position may be maintained among the scientific institutions of the country. A new era of activity has been entered upon and much has already been accomplished. The latitude and longitude of the observatory have been carefully determined. Transit observations are continually made for the regulation of the standard time of Cincinnati. For this purpose telegraphic signals are transmitted to the municipal departments, and a ball is dropped from a staff at the observatory each day at noon. Much attention is necessarily paid to a great variety of miscellaneous observations and investigations, but observations of double stars form the chief work of the institution. Of these more than 3,000 measures have already been made, and about 150 new ones discovered. Only one assistant, Mr. H. A. Howe, is employed.—*Daily Graphic.*

GEOGRAPHY.

THE PROPOSED ENGLISH BALLOON ARCTIC EXPEDITION.

Next May, the *Army and Navy Gazette* says, is named as the probable time of departure of Commander Cheyne's new Arctic expedition for the discovery of the North Pole. By the exertions af Commander Cheyne, a London Arctic Committee has been established at the head of forty-nine provincial committees. The expedition will co-operate with those sent out by Sweden, Holland, America, Austria and Denmark. The following letter has been sent by Lord Derby to Commander Cheyne:

"DEAR SIR: Having heard your scheme of a new Arctic expedition fully explained in our conversation to-day, I have the pleasure of promising a contribution of £100 in aid of it should you succeed, as I hope you may, in obtaining support to justify you in going on with it. I remain faithfully yours, DERBY."

On Arctic ballooning Commander Cheyne says:

"It having been suggested to me that the collapse of the Paris captive balloon might bear unfavorably upon the project for ballooning in the Arctic regions, as regarded by the public, I beg at once to state that no such accident could occur to balloons while exploring *en route* to the North Pole, for the simple reason that the three Arctic balloons would be free and quietly float with the wind, whereas the Paris balloon was captive and was disabled in consequence of a violent squall of wind against which I had to contend, somewhat resembling a ship being knocked to pieces on a lee shore, instead of being safe under snug canvas in mid-ocean. Again, the three Arctic balloons will only be about forty hours from the ship to the North Pole and about the same time on return; yet the Paris balloon has stood its work well for fifteen months.

"I am, sir, your obedient servant, JOHN P. CHEYNE.

"Commander Royal Navy, Proposed Commander of the New Arctic Expedition, No. 1 Westgate Terrace, West Brompton, August 18."

THE "HERALD" ARCTIC EXPEDITION.

The Jeannette, which left San Francisco July 8th, reached Oonalaska, in the Aleutian Islands, August 2d, having made a slow but satisfactory passage to that point. After taking on some supplies of food and clothing, previously collected there for this purpose, she started north with every prospect of a clear passage through the Straits, as the season has been an unusually open one in that latitude.

THE FRANKLIN SEARCH EXPEDITION.

This expedition, which sailed from New York on the 19th of June, 1878, went into winter quarters on the 9th of August of the same year, on the northern shore of Hudson's Bay, in about latitude 64° N. and longitude 90° W. The information in reference to the missing records of Sir John Franklin, which formed the basis of the search, has been found very unreliable, as will be seen by the following extract from the report of a member of the expedition:

"Since landing from the Eothen at that camp, every effort has been made to trace to its foundation the story upon which the expedition was based, and so far we have succeeded in ascertaining that there was no truth in it. Before leaving New York we were led to believe that there were residing with the Iwillich Esquimaux two Natchilli natives, one of whom had given a spoon to Captain

Barry; that subsequently, while writing in his log book, he overheard these two men remark that in the cairn from which they had taken the spoon were articles similar in character to the log, and as the spoon had been identified as belonging to one of the officers of Sir John Franklin's party, the presumption was most natural that the articles referred to were indeed the long lost records of that ill-fated expedition. This was indeed sufficiently direct testimony to warrant a vigorous search, and when, as was stated, they offered to conduct Captain Barry directly to that cairn, the lab.r of a search party seemed to be reduced simply to that of a journey over a difficult route to a goal that was well known to its guides. But it appears now that Captain Barry got the spoon while on Depot Island, after having been shipwrecked on the whaler A. Houghton in 1877, and that any conversation that was had about cairns was while on a previous voyage and at Repulse Bay. Furthermore, it is quite evident to any one who has been much with the natives of this region that neither Captain Barry nor any other white man would be able to understand them while conversing with each other, although he might be able to make them understand him if he desired to talk to them."

It is to be regretted that the learned President of the American Geographical Society permitted himself to be so widely misled by the story of the whaler Barry, opposed, as it was, to the actual knowledge of others—among them Dr. John Rae—familiar with the localities referred to in his statement. Although it seems probable that the expedition will be unsuccessful in accomplishing the main object for which it was fitted out, there is reason to hope that the labors of the scientific members of the party will be productive of good results.

NORDENSKJOLD'S EXPEDITION.

The Swedish exploring steamer Vega, belonging to the Nordensjöld expedition, arrived at Yokohama September 2d, having successfully accomplished the Northeast Passage. The expedition sailed from Gothenburg on July 4, 1878, and a four days' sail brought it to Tromsöe (a Norwegian port on an island of the same name), where the outfit of furs and necessaries for the high latitudes was completed. Here the Vega was joined by the companion steamer, the Lena. On July 25th both vessels sailed from Tromsöe, passed through the Yugor Strait (south of Nova Zembla) on August 5th. There was not a particle of ice to be seen between Waigatsch (Vaigatz, a Russian island) and the continent. The Kara Sea, hitherto dreaded by all sailors in the Arctic regions, was equally free from ice, and anchor was cast at Port Dickson, near the mouth of the Yenessi, on August 6th.

After a three day's delay there the two steamers steered northeast toward the dreaded Taimur land and the North Cape. The ice arrested their passage and they were compelled to remain at Tajoyr (Cape Taimur?) four days. On August 19th, Tsejdekin, the extreme northern point of Asia, was reached, where a short

rest was taken. The Vega coasted the peninsula, very little ice being encountered, and anchored at the mouth of the Lena river on August 26th. To the northeastward were the islands of New Siberia, which were soon sighted, but were not explored because of the great fields of ice that girt their shores. The mouth of the Kolwya river (latitude 69° 30′, longitude 161° 30′), a broad estuary, was found open. The difficulties soon began, however, and increased daily. They were delayed much by the ice between Cape Cook and Van Karema. They crossed Kolintsehm Bay on September 27th with comparative ease, but were imprisoned on the 28th near a Tchuktchi settlement (latitude 67° 7′ N., longitude 177° 24′ W.)

The vessels wintered in the pack ice at this point, one mile from land. The entire ship's company maintained the best of health and spirits. Not a single case of scurvy occurred on board. During the shortest day the sun was above the horizon less than three hours, and then only the upper limb was visible. At this point much time was devoted to interesting scientific and ethnographic studies. There were 4,000 inhabitants in the several villages near by, who subsisted by fishing and sealing. They are called the Tchuktchi, and are a very agreeable class of people for an exploring party to meet. They supplied the expedition with bear and reindeer meat. The cold was intense, averaging 36° centigrade (32.2° below Fahrenheit). The game was abundant in the spring, wild fowl being taken in large numbers. They were detained in the ice at this point 264 days, but were released on July 18th, 1879, and passed East Cape into Behring Sraits on the 20th.

The Professor says:

"I fully accomplished the object for which the expedition was sent out by Dr. Dickson—namely, a practical proof of the existence of a Northeast Passage. Then the Asiatic coast was followed and St. Lawrence Bay was crossed to Port Clarence, Alaska. Thence we crossed to Koniyan, dredging carefully in order to determine the formation of the bottom of the sea, many specimens of the fauna and flora being obtained. The location, breadth, velocity and approximate volume of the Arctic and Pacific Polar currents were charted and calculated. Having touched at St. Lawrence Island, we next proceeded to Behring Island, where we received the first news from Europe through the resident agent of the Alaska Trading Company. The fossil remains on Behring Island are of immense variety. A new marine animal was here discovered, which we named *Rhytina stellari*. The Vega left the island on August 19th, and had a pleasant voyage until August 31st, when a severe gale was encountered, accompanied with lightning. During the storm, the lightning struck and shivered the main-top-mast, slightly injuring several men. We arrived off Yokohama at half-past eight on the evening of September 2d. All are well and no deaths have occurred during the voyage.

"The Vega is the first vessel to make the passage, and I think the voyage from Europe to Asia by Behring Strait is certain and safe, with very little more experience of navigation in the Northern seas. From Japan to the mouth of the

Lena river there are no difficulties in the proper season, for experienced sailors. The Lena river taps Central Siberia, and a large prospective trade can readily be developed."

CORRESPONDENCE.

SCIENCE LETTER FROM PARIS.

THE MECHANISM OF THOUGHT—PLANETS YET TO BE DISCOVERED—ORIGIN OF COAL AND RAIN.

PARIS, August 1, 1879.

Mind has been compared to a store-house of images mutually dependent on each other. These images are produced by sensations, then grouped and lodged in cerebral cells. Suppose we have witnessed some emotional spectacle—a surgical operation, for example. We saw it yesterday, and can recall it to-day in its fullest reality. The mechanism of thought is thus constituted by the sensation of a sensual organ, sight, the perception of this sensation by nervous centers and its fixation in the state of image, and the power to recall this image. Sight has furnished the illustration, but hearing, tasting, smelling, and feeling could do the same. The resurrection of the image complete and precise, is sanity. When the image is no longer taken for what it is, that is, the souvenir of an impression, but for the impression itself, this state is called hallucination. The mind has not cognizance of the illusion or phantom; it believes to have taken what it wants from a different brain cell. Nightmare is an example of this illusion, but which is dissipated at the slightest material event, the touch of the bedclothes, or another mental image, recalling reality. Such is the condition of a healthy brain, but in the case of a diseased one, the hallucination dominates so much the region of the brain as to prevent the production of new or sane pictures. The lunatic cannot see the veil which separates reality any more than a bird the obstacle when pecking at a pane of glass to reach a plant on the other side.

I have stated that thought consists of three phases—the perception of the senation, its fixation and conversion into a picture, and the power to recall tha image unconsciously stored in the brain. Now these three processes are produced by three different nervous functions, so that psychology and physiolology are at last united after being for centuries foes.

The first operation of sensation takes place in the spinal marrow and in the intermediary parts between the two hemispheres of the brain. Deprive an animal of its brain, then pinch the paw; it will retire the latter with a cry. But this is not an exclamation of conscient pain; it is automatic—as mechanical as a parrot's

"How do you do?" The brain has no more to do with the act than it has when we sneeze or cough. It is only when the sensation has been stored up that it can be reproduced as a souvenir; and the more the coats of the brain are extensive and developed, the sharper and more powerful will be the memory. When accident or general paralysis alters or diminishes these coats, thought becomes characteristically slow.

M. Munk, a distinguished German, has just demonstrated, by vivisections, that it is in the gray substance of the lobes of the brain that sensations lodge; that each special sensation has a special center, and that if a part of this gray matter be removed the animal will become mentally blind. The sight of a whip that formerly would make it run and hide in a corner, leaves it now quite indifferent. It remains insensible to ordinary signs. If a dog, it will no longer stand on its hind legs when ordered, or give the paw when demanded. If hungry or thirsty, it knows no more where to find its food, but when found it recognizes food and drink as old acquaintances, and tries to remake its education. The animal resembles a person, blind from birth, that an operation restores to sight and suddenly places in an unknown world. If the paw of a healthy dog is pinched, it will not only cry, but attempt to bite to defend itself. In the case of the dog previously alluded to, no attempt is made at defense. It can perform no conscient act, being deprived of the cerebral seat of comprehension. Similarly, when the coats of the brain are inflamed, a person, after making sundry oscillations to shake you by the hand, finishes by seizing his own nose.

It was formerly believed that the whole of the brain was employed in the same functions. M. Broca, in 1864, demonstrated a center specially reserved to language, in the left cerebral lobe, and in the region of the forehead. When this special point was injured language became suppressed. Hitzig, in 1870, placed the matter beyond doubt, for, in exciting the cerebral envelope by an electric current in the same place, he invariably produced corresponding muscular contractions of the face.

M Munk also shows that, while the whole brain matter is capable of performing the same functions, each function tends to occupy a distinct place in the mass of gray matter. There are thus certain motive-nerves for carrying the thoughts, so as to be converted into movement, and these nerves, or routes, when destroyed are capable of being re-made, or new ones created.

The idea-nerves are totally distinct from the carrying ones. Cut off the head of a frog; it will swim till it dies, because it is an automatic or muscular fact. In an aged subject, it will perform movements of an habitual nature. Cut off the head of a pigeon; it will place the stump of the neck under its wing. A young pigeon will never do so; hence the force of habit. Brosses wrote, in 1765, that the germs of speech, or the inflections of the human voice, are necessarily physical effects, and the first syllables a child pronounces are labials, because the lips, accustomed to sucking, are the parts the most agile. As the child advances in age, the efforts of memory are markedly automatic. A school boy, by repeating

aloud his lesson, can, when he falters, recall the following words by the mere sound of their predecessors—a purely mechanical operation. Habit, "that violent and treacherous school-mistress," as Montague wrote, is not our second, but our first nature. What are our most predominating ideas? Those of our youth, for the first images were easily engraved in the memory. They found the storehouse, the brain, unoccupied, and, as first arrivals, helped themselves to the best places. Later ideas had to go up higher and occupy less favorable cells. It is thus that when senility sets in they are the images, the souvenirs of youth, that are the most dearly caress d and that form the last dreams of life.

Such, then, is the present state of the question of the mechanism of thought. Science cannot explain the play of these nervous cells which makes one person virtuous and another criminal. The physiologist has only to deal with perceptible phenomena. Between the physical and the moral world there is still a great gulf fixed.

The world appears to be to-day almost as contented as the ancients, with their orthodox seven planets, and which have given their names to the days of the week. Indeed it was once a heresy to suppose the sky contained any others, and Herschel broke the charm by discovering, in 1781, *Georgium Sidus*, named after his royal benefactor, but which astronominal opinion forced to be changed to Uranus—the oldest of the gods. No other important planet was discovered till 1846, when LeVerrier made known Neptune. Kepler, remembering Plato's observation that God in creating the world must have known geometry, sought for a long time to discover a law regulating the distances between the planets, and which he expressed in a very simple series. Something was wanting in the calculation of those little stars called "telescopic planets." Hitherto they were named Ceres, Juno, Vesta, etc., but becoming so plentiful, they were baptized with a number. In 1874 they were 134; in 1879, 198, and it is estimated that there are 160,000 yet to discover. These stars are very tiny, hardly the size of an ordinary shire. A good pedestrian could make the tour of one of these worlds in twenty-four hours. In point of theory, these *petits* are important. Where do they go, or where have they come from? Olbers concludes they are the fragments of a planet. If so, they ought, after making their revolutions and following a mechanical law, to return to their common point of departure, which they do not—Juno excepted. In Laplace's theory, the solar system at its origin was an immense nebulus, which on cooling detached planets under the form of globules; and Roche has established that these tiny stars need not necessarily take an elliptical form. LeVerrier has calculated that the mass of these telescopic planets is limited, and ought not to exceed one-third the mass of the earth; and Messrs. Seidel and Argelander compute that the dimensions of fifty of the most notable of these little stars do not exceed in their total the ten-thousandth part of the earth's volume At this rate, 160,000, as remarked, may yet be discovered.

What is the origin of coal and of rain—two important subjects? Coal was supposed to be produced by some clumsy process of pressure—more supposititious than exact. Coal beds are the product of accumulated masses of vegetation, of which bogs represent one of the stages of formation. But no one has ever been able to make coal, even under heat and pressure applied to vegetation, as presumed by MM. Daubrée and Baroullier. M. Frémy tried to do so, but could not transform vegetable organisms into coal. However, he took vegetable products, as sugar, starch, gum, and the green matter of plants, calcined them and obtained something resembling coal. Indeed, on heating the residuum he produced water, gas, tar, and even coke. He concluded that the ultimate product of vegetable decomposition is ulmic acid; that turf in some of its stages contains sixty per cent of this substance, and when heated under pressure and during 200 hours, becomes transformed into a matter identical with coal. The latter, then, is peat, dating from ancient geological epochs, and transformed by fermentation, where the organism of the tissues has disappeared, and the resulting ulmic acid, under the influence of heat and pressure, becomes coal. Respecting the marks of plants in coal, they are produced by a moulding process peculiar to schists and other mineral substances.

Where does the rain come from, or why does it fall so mercilessly in our regions? Scientists afford no positive solution, save to reject the theory of relation between spots on the sun and constant rain. The minimum of spots ought to coincide with dry years. Unfortunately, the contrary has just been the case in Europe. At the equator, the sun evaporates unceasingly the waters of the oceans, converting them into vapor, which latter, when drawn toward the poles by currents, encounters cold, is condensed and, the air being saturated, falls as rain. The sun pumps up water from the ocean. At the tropics the evaporation must be nearly uniform, as the temperature is so, and, consequently, the amount of water in the air that is condensed as rain ought to be about the same. But the inequality of the rainfall is due to the course of the rain currents. Where these are less frequent fine weather will be more general. As the sun approaches the equator, the zone of bad weather follows the planet. Some writers are of the opinion that the moon exercises an influence on the march of atmospheric currents by her *declinaison*, or relative position above or below the equator, which varies between 18 and 29 degrees, while the sun's is constantly 23 degrees. The nearer the moon approaches to the maximum number of degrees, the more the seasons are humid.

Messrs. Martin and Richet conclude that the injection of milk into the veins is generally mortal, and believe that the diuretic action of milk is due to the sugar it contains.

PROCEEDINGS OF SOCIETIES

THE SARATOGA MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

BY A MEMBER PRESENT.

Why a town so eminently unscientific as Saratoga should have been chosen for the meeting this year of the American Association for the Advancement of Science, is to be explained only upon the supposition that the managers knew more about the welcome we should have there than did we of the commonality, while everybody concluded that he would "have a good time and take his wife." At any rate, a striking feature of the meeting this year was the large number in attendance. And they were all men with a little money in their pockets and a little knowledge of carpet etiquette. The scant-sleaved gawky from some country college, whose forte is mathematics and destination to be distinguished in ininvention; the shy professor from a rural academy, whose specialties are short-sightedness and diffidence; the irresponsible bore who hangs around such meetings in the hope of taking part in some discussion for which he has fitness; the slovenly woman of science who wishes to read an essay—all these were absent from the Saratoga meeting, which is equivalent to saying they have been seen elsewhere. Of course, they would have been welcome and properly valued in the sessions, but either their short purses or their exaggerated appreciation of the brilliant society of the Springs, caused them to stay away.

The laboring oar of the Local Committee was Captain A. R. McNair, of the Navy, whose efforts toward our comfort and indulgence were indefatigable. The usual arrangements were made for reduced rates on the railroads and at several of the hotels. The large hotels were greatly crowded, however, with ordinary guests. When, therefore, the dusty man of science presented himself at the desk of the United States and claimed the room which he had been told had been engaged for him, he was informed that there were no rooms, or at least that he could have none until "to-morrow." However, when some of the wise ones, holding their heads up, registered and called for rooms, saying nothing about the Association, they got them quickly enough, and afterward paid at the reduced rate. At some of the lesser hostelries, like that fine little "Waverly House," we had no such trouble.

It was good fun to see how the "butterflies" around the hotels and in the park regarded the Association. It was a patronizing, pitying sort of an air. They had their jokes, and did not hesitate to do their own laughing. But this finally changed when they found we were not all ourangs. This was partly due to our

wives and daughters, who supported us nobly. As I remarked, these wives and daughters of ours were by no means "frights" and "blue-stockings." They dressed as well (a great deal better so far as taste went), behaved as well, and were just as gay, witty, accomplished and charmingly *neglige* as Saratoga's belles, matrons and misses. The fact that they were wiser was no disparagement. Nevertheless, some funny people came to the meetings now and then, as they always do, but there was a gratifying absence of bores.

The exercises were of a very interesting character, and rather an unusual amount of enthusiasm was manifested. Thirty-six fellows and two hundred and ten new members were elected. The number of old members present was two hundred and fifty-eight, and one hundred and fifty-four papers on various scientific subjects were entered.

Your readers will certainly excuse me for not writing out what has been so well said in the following abstracts, culled from such reliable and able periodicals as *Science News*, *Scientific American*, etc.:

The address of President Barker was the principal feature of the morning session of the first day. In the course of his remarks, the object of the Association was declared to be the advancement of science not only by the discovery of new truth, but also by the diffusion of that already known To this end it extends a cordial recognition to all organizations of whatever sort whose objects are akin to its own. Being itself national in character—for science knows no country and no section of country—it gives its indorsement to all local enterprises, and stands ready to assist them in any legitimate way. Whether it be a State, geological, or topographical survey, an academy of science, or association or individual seeking to unravel nature's secrets, the Association desires to strengthen their bonds and to uphold them in the communities where they are located. Its province is to awaken an interest in pure science; or, where such interest already exists, to develop it to the full. It invites all interested in science to its membership, and opens its sessions to all comers. That its periodical and migratory meetings, in the words of the constitution, have actually done what they intended to do, have promoted intercourse between those who are cultivating science in different parts of America, have given a stronger and more general impulse and a more systematic direction to scientific research, and have procured for the labors of scientific men increased facilities and a wider usefulness, no one who has watched its history can doubt.

Less perfect acceptance, we fancy, will be accorded Mr. Barker's subsequent remarks, in which he excludes inventors from the ranks of original investigators and discoverers. It is true that in many instances the discoverer has not been an inventor, and that discovery has usually been the real mother of invention; true, also, that original research is the storehouse out of which comes invention. But it will not do to assume, as Mr. Barker appears to, that discoveries are made only or generally by men who "patiently investigate truth for its own sake," and "deny" themselves "the good things of this life to obtain it." There is rising up among us a generation of inventors, who are also explorers and discovers of the

most energetic and successful type; and they push the work of investigation and invention with no intention of denying themselves the good things of life. Their inventions pay, but their discoveries are none the less scientific and honorable.

The title of Prof. Marsh's address is "The History and Methods of Palæontology." It is quite certain that no man in this country is more competent than Prof. Marsh to compile and write on this theme. He has for years been collecting a library of works on the subject, and of these many, and perhaps the most important, are in German—a language and literature with which he is familiar. The address is by no means, however, a mere compilation; its author recognizes the far-reaching results to which the rocks and fossils are leading us, and regards them as giving a promising path toward solving the question of questions, "What is life?"

The historical portion of the address divides the progress of Palæontology into four epochs. The first of these begins with the earliest literature and ends at the eighteenth century. During that whole period, the nature of fossils—whether they were freaks of nature or the remains of animal life—was the subject of bitter dispute, and the question remained open. Mostly the theory of the ancients and of the earlier moderns on this subject were fantastic; though in a few instances correct views were advocated. The notion long held sway that fermentation or a plastic force in nature had developed fossil forms. In the second period, reaching from the beginning to near the close of the eighteenth century, the belief prevailed that fossils were deposited by the Mosaic deluge. Prof. Marsh has preserved many entertaining incidents and facts connected with this period, when it was the fashion to regard fossils as belonging to that wicked world which was destroyed by the flood, and huge saurian remains were supposed to be portions of human skeletons belonging to the accursed sons of Anak. The third lasted till about twenty years ago, and was characterized by correct views as to the general nature of fossils, but was embarrassed by a belief that every species, extinct and living, had a separate creation. The last period—the present—is distinguished by the acceptance of the doctrine of evolution. Professor Marsh dates the revolution in belief on this subject from the publication of Darwin's "Origin of Species" in 1859. The characteristics of the present period in Palæontology were stated as "the belief that all life, living and extinct, has been evolved from simple forms," and "the accepted fact of the great antiquity of the human race."

The progress made during the past twenty years in this science is very great. The address enumerated many of the noteworthy additions to the number of extinct species. A more important fact is that the genealogies of various existing mammals have been traced with considerable probability through allied forms in closely-connected series. The evolution of the horse, Professor Marsh asserts, is to-day demonstrated by species now known. "The demonstration in one case stands for all." The active workers of science regard it as "a waste of time to discuss the truth of evolution; the battle on this point has been fought and won." The address concluded with a brief review of the evidence for the antiquity of

man. His existence in the quaternary epoch, it is said, is now generally accepted. Prof. Marsh favors a view expressed on "high authority," estimating the antiquity of man in Europe, judged by the glacial epoch, as 250,000 years. There is also strong evidence of a yet earlier existence in the Pliocene of America.

Justice cannot in a contracted space be done to the address of Prof. Marsh, which teems with apt citations, entertaining lore and shrewd suggestion. It ended in these remarkable words:

"I have endeavored to define clearly the different periods in the history of Palæontology. If I may venture, in conclusion, to characterize the present period in all departments of science, its main feature would be a *belief in universal laws*. The reign of Law, first recognized in the physical world, has now been extended to Life, as well. In return, Life has given to inanimate nature the key to her profounder mysteries—Evolution, which embraces the universe.

What is to be the main characteristic of the next period? No one now can tell. But if we are permitted to continue in imagination the rapidly converging lines of research pursued to-day, they seem to meet at the point where organic and inorganic nature become one. That this point will yet be reached, I cannot doubt."

The annual address on "Solar Physics," before Section A, was delivered by its presiding officer, Professor S. P. Langley, the astronomer of Allegheny Observatory, who is himself specially distinguished by successful researches concerning the light, heat, and physical constitution of the sun. The address was in part historical, and gave full credit in turn to the successive students of the solar surface who have gradually developed a branch of science that is wholly modern.

Prof. Langley described the improved photographs of the sun which he had recently seen at the observatory of M. Jannsen. The original negatives are on a scale of about thirty inches to the solar diameter, and will bear enlargement to nearly ten feet, with remarkable precision. One of these negatives, containing over a million distinct cloud-forms, can be taken in 1-3000th of a second. By such means eye-studies can be wholly superseded, and when sun-spots appear, their birth, extension and disappearance can be better understood. The reproduction of spectral lines by photography, for which so much credit is due to Mr. Rutherfurd, has led recently to more surprising results in the hands of Captain Abney, of the Royal Engineers, South Kensington, who has photographed the red end of the spectrum and far beyond it, to a wave-length of 12,000. That is, we can photograph non-luminous objects, in total darkness, simply by their heat rays. The discovery indicates that we may yet photograph any object that is giving out heat, even though the temperature may not exceed the boiling point of water. M. Cornu has worked at the other end of the spectrum, and extended it beyond the violet ray to a wave-length of 2,900. These extensions of our knowledge of the spectrum have taken place within the past year. Mr. Lockyer has shown reason for belief that many of the so-called elements are really compound bodies, which are incompletely dissociated at the highest temperature we can command, and Dr.

Henry Draper has brought forward evidence, still under discussion, of an element being present in the sun which was not previously detected there. Prof. Langley urged the need of a physical observatory in this country upon some elevated station such as that recently constructed upon Mount Etna.

The Nestor of mathematical science in America, Prof. Benjamin Peirce, of Cambridge, a grand old gentleman with a wealth of iron-gray hair and flowing beard, spoke rapidly and without notes, on "The Meteoric Constitution of the Sidereal Universe, and the Cooling of the Sun." The subject is closely connected with the nebular hypothesis. But it is best, Prof. Peirce thinks, first to see what is the present state of things before we go back to the beginning. Let us see what is going on now. A paper on the physical constitution of the sun, by Sir William Thomson, was referred to by Prof. Peirce with high approval. The further any methematical investigation is made in this class of researches, the more frequently difficulties arise; but the more we make science infinite rather than finite, the more we make it worthy to be studied by an infinite being. In a fine clear evening we see the stars, and, therefore, we believe in them. But when it is clouded you yet believe in them quite as much as before. Similarly, to the geometer, the planets which at times disappear, but yet can be predicted to return, are known to be in their appointed places. There are heavenly bodies—meteors—which we seldom see three minutes at a time, and usually for only a few seconds. Yet we know that these have existence elsewhere before we see them. If these invisible meteors were abstracted from the universe, the fires of the sun and stars would ultimately go out and everything be left in darkness. All matter is but the concatenation of meteors, whether it takes the form of suns, planets, nebulæ, comets, or meteor streams. Small meteoric bodies are naturally cold, and hence invisible. This is probably the natural condition of matter, or at all eveuts of meteors. The ingredients of meteors may be of the most various kind; the carbon contained in those which reach the earth may be burned out.

Prof. Peirce does not believe in the accepted theory that a gas must give a continuous spectrum. He believes that all stellar light is produced by superheated gas, the heat being too great for the possibility that anything but gas can be present. He referred with favor to the theory advanced by Mr. Lane, of Washington, that a gaseous body, giving out heat, must be every moment growing hotter, In the case of the sun, if it were contracted to half its size, the pressure would be sixteen times greater on each cubic foot, and hence the sun would be apt to grow hotter by comparison as it grows older. It is likely to become rather hotter than colder, but probably there will not be much change. Astronomers have adopted the brightness of the stars as a measure of their brilliancy. The elder Struve brought an objection to this, that the small stars do not increase in number as rapidly as they should in proportion to the large ones. Perhaps the presence of dark meteors in celestial space cuts off the light of very distant stars. We must believe that clusters, like those of Hercules, consist of stars that are comparatively near each other. We have no reason for supposing that there are any

stars more distant from us than the smallest stars of the milky-way. The concentration in the plane of the milky-way has been such that all space outside of it is comparatively clear of stars. But the nebulæ are most numerous at right angles, or perpendicular to this plane. They would not be visible, perhaps, if they were in the milky-way, because so distant, as compared with other regions of the sky.

To the ordinary form of the nebular hypothesis Prof. Peirce strongly objects, but he does not wholly oppose it, his views now differing from those he expressed several years ago. The ordinary theory is that a series of rings preceded the formation of the planets, and that these rings broke to pieces and then re-united. He showed that planets formed from such rings would have a retrograde motion instead of the forward motion which they actually have. He believes that the forward motion is a proof that the planets, as well as the sun itself, were produced by the collision and adhesion of meteors. It does not follow that all the meteors were absorbed; there are probably myriads yet outside the solar system.

Major Powell's treatment of Mythologic Philosophy was not only intensely interesting and suggestive, but singularly original, and freighted with a wealth of information with regard to the mental conditions of American savages. No better evidence could be given of Major Powell's fitness for the work he is engaged in under the auspices of the Smithsonion Institution.

Mr. Edison's researches in connection with the behavior of highly heated metals in vacuo are certainly promising. Possibly they mark the opening up a new department in the practical treatment of metals, as well as in scientific metallurgy. Whatever may be the issue of Mr. Edison's efforts in the direction of electric lighting, the results of his investigations are certainly important in furnishing valuable contributions to science.

Professor Leeds, of Stevens Institute, reviewed the long standing problem as to the solubility of ozone in water, and gave the reasons for believing that it is so dissolved, and that it retains in the solution its characteristic oxidizing power.

Prof. H. W. Wiley, of Purdue University, Lafayette, Indiana, described an improved method of collecting and measuring gases soluble in water; and Prof. F. W. Clarke, of Cincinnati, gave a preliminary notice of results obtained in an elaborate revision of the calculations determining the atomic weights of the chemical elements.

The paper of Prof. Goode, of Middletown, Connecticut, on the Menhaden, presented that cousin of the shad as not only the most valuable of the food supplies of edible fishes, but as the most important source of fish oil. Its annual yield of oil exceeds that of the whale (from American fisheries) by 200,000 gallons; and in the commercial value of all of its products it is surpassed by but three fisheries: the cod fishery, estimated in 1876 as yielding $4,826,000; the whale fishery, $2,850,000; the mackerel, $2,275,000. The value of the menhaden taken this year amounted to $1,658,000.

Commander E. P. Lull, U. S. N., read an important and timely paper on

the Inter-oceanic Canal Problem, illustrating by maps and diagrams the several routes surveyed. The character and advantages of the Nicaragua route were specially dwelt upon, and the belief was positively expressed that no commercially practical route without locks had been found.

Prof. Draper's paper on the Identity of the Lines of Oxygen with Bright Solar Lines, as shown in photographs taken with increased dispersion, was read, in his absence, by Prof. Barker.

A very popular and enjoyable paper was Mr. Wm. T. Hornaday's on the Orang-Outangs of Borneo. Touching the possible human relationship of the orangs, Mr. Hornaday said:

"Let such a one (if, indeed, such a one exists to-day), who is prejudiced against Darwinian views, go to the forests of Borneo. Let him there watch from day to day this strangely human form in all its various phases of existence. Let him see it climb, walk, build its nest, eat and drink, and fight like human 'roughs.' Let him see the female suckle her young and carry it astride her hip precisely as do the Cooly women of Hindostan. Let him witness their human-like emotions of affection, satisfaction, pain, and childish rage. Let him see all this, and then he may feel how much more patent has been this lesson than all he has read in pages of abstract ratiocination."

Another interesting paper was on Serpent Myths of the Red Men, by Judge J. G. Henderson, whose paper on superstitions connected with the rabbit, among our Indians and other primitive people, had been listened to the day before.

Mr. Edison's electro-chemical telephone was exhibited and explained by Prof. Barker, Mr. Edison, the inventor, acting also as draughtsman for the blackboard illustrations.

President Barnard, of Columbia College, read a paper on the Past State of the World's Metrology as Bearing on the Progress of Science, in which the progress of modern science was shown to hinge on the possession of exacter means of measurement than the world had previously known.

In this brief notice it is obviously impossible to do anything like justice to the multitude of valuable papers presented to the Association. It has been an active, earnest, business-like session, as notable for its good work as for its full attendance. The place of meeting had been happily chosen, the weather was favorable, and all the external conditions conspired to make the meeting as pleasant as it was profitable.

It was resolved that the next place of meeting be at Boston, Massachusetts, on the last Wednesday of August, 1880.

On behalf of Boston, Professors Rogers, Scudder, Heustis and Putnam returned thanks to the Association for its choice of location.

The officers chosen for the ensuing year were as follows: President, Hon. L. H. Morgan, of Rochester, New York; Vice President of Section A, Prof. Asaph Hall, of Washington, D. C.; Vice President of Section B, Alex. Agassiz, of Cambridge, Massachusetts; Permanent Secretary, Prof. F. W. Putnam, of

Cambridge, Massachusetts; General Secretary, Prof. John K. Rees, of St. Louis, Missouri; Secretary of Section A, Prof. H. B. Nason, of Troy, New York; Secretary of Section B, Prof. C. V. Riley, of Washington, D. C.; Treasurer, Wm. S. Vaux, of Philadelphia, Pa.

THE SHEFFIELD MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The British Association for the Advancement of Science held its forty-ninth annual meeting at Sheffield, the session closing August 28th. The meeting was not as well attended as the one in Dublin last year, still it was quite successful. Many important questions were discussed, of which we give a few selections:

Captain Bedford Pim, R. N., read a paper on the proposed canal across the Isthmus of Panama, which attracted considerable attention. The author first observed that no one disputed the possibility of making such a canal, and it was generally acknowledged that it might be made a paying concern. The choice of a route depended upon the terminal points or harbors, and a still more important feature was the physical geography of the sea in the neighborhood of the ports, for if sailing ships were able freely to enter and depart, the success of the undertaking was secured. At least half of England's 21,000 sailing ships would use the canal, but if nature placed an irresistible barrier to the approach of these ships, a deep shadow would be cast upon the future outlook of the undertaking. He suggested a route parallel to the river San Juan, with a canal of very different dimensions to, and cost of, that at present contemplated. Starting from Monkey Point, now called Pinis Bay, forty miles north of Greytown, he would cut a canal from the inner part of the bay down to the Rama river, a distance of some nine miles. The Rama river itself carried deep water some twenty miles into the interior, and the remaining seventy miles to the lake of Nacaragua would traverse land offering no particular difficulty. From San Miguelito, on Lake Nicaragua, by way of Tipiteta to the northern shores of Lake Nicaragua, there was nothing which an engineer would consider a difficulty, and the remainder of the canal to Port Realejo could scarcely be said to afford any field for engineering skill. In that scheme a deep water canal was not even contemplated. A depth of eight feet would be amply sufficient, the vessels being transported on pontoons, such as had been successfully used in the Victoria Dock for some years. Such a plan would considerably reduce the cost, while other advantages would be gained, such as cleaning the ships' bottoms while on the pontoons, which would effect a saving to owners almost, if not quite, sufficient to pay the canal dues.

The canal would not cost more than ten millions. If England and America would join hands and each guarantee 1½ per cent on that amount, there would be a joint guaranty of 3 per cent, an indication sufficient for English investors alone to take up the sum in less than a week. What was 1½ per cent on ten millions? One hundred and fifty thousand a year, a sum annually wasted on

any vote exceeding one million of the navy estimates. And what did we get for our money? A consolidation of the friendly feeling between this country and the United States, far more lasting and binding than could be effected by any treaty between the two nations merely guaranteeing the neutrality of the route. The representative of the American Government at the Paris Congress left no room for doubt as to the line of canal preferred by his government, and clearly and unmistakably pointed to Nicaragua as the best. He (Captain Pim) trusted the government of Great Britain would not, for the sake of saving the annual part of £150,000 for a few years, find themselves ultimately compelled to purchase an interest in the new highway at any price which might then be demanded. He most earnestly hoped that the day would not be far distant when we should see the completion of this great work of inter-oceanic canalization across Central America. He believed that such an undertaking would give a beneficial stimulus to the commerce of the whole world, and, consequently, could not fail to be a great and common boon to mankind.

M. Bergeron said there were many objections to M. de Lesseps' scheme, and many engineers were opposed to it. He quite agreed with the deductions of Captain Pim.

Captain Galton thought one of the difficulties of M. de Lesseps' canal was how to cut one that size through such a country and in such an unhealthy climate. He asked Captain Pim whether it was necessary in the Nicaraguan system to raise ships my means of pontoons in order to carry them across certain distances. That seemed to him to interpose enormous difficulties in the work of the canal, which to be universally applicable must be simple and effective.

Mr. R. B. Grantham thought the mode of transporting ships through the canal, as proposed, would be a difficult matter, and it was a question whether the pontoons would not be so expensive as to overbalance the expense of a greater depth of canal.

Mr. E. A. Cowper pointed out that a pontoon large enough to transport a laden ship through the canal would necessarily have a great displacement, so that the pontoons would have to be large, and so would the canal.

Captain Pim said that he had only suggested the shallow canal because he feared that it would be impossible to so improve the delta of the San Juan river as to make it a proper harbor. Of course, every one would prefer to sail through the canal rather than to have to be hoisted through on a pontoon. A pontoon with a large ship on it would only draw four feet of water. He had seen laden ships easily raised on a pontoon. His suggestion was merely made on the supposition that the delta of the San Juan could not be improved, but he did not, of course, for a moment presume to say that it was the right one. A deep water canal through the route he had mentioned would cost £30,000,000 sterling, a sum sufficiently large to frighten both Great Britain and America. A shallow canal, such as the one he had suggested, would cost about £10,000,000 sterling. Of course, if the smaller scheme were carried out it could afterward be improved.

Captain Cameron, in the Geographical section, read a paper on the "Euphrates Valley Railway," previously to which he spoke of the Island of Cyprus, which he had visited. He said, in substance:

The island of Cyprus would prove of great advantage to the British Crown. It was of strategical importance, and was also valuable as showing what, under good government, even with Turkish laws, which had been so much abused, properly applied, Asiatic Turkey was capable of. Cyprus was said to be unhealthy. There was a great deal of sickness among the troops, but it must be remembered that they were landed and went into tents at the worst season of the year. Coming to the subject of his paper, he discussed the various proposed routes for a railway to India, and thought the most prominent one was from Tripoli to Aleppo, in the valley of the Tigris, to Bagdad, and thence to Bushire. The local traffic already existing was very considerable, and would almost immediately increase enormously. With Tripoli as the Mediterranean terminus, there would be many and great advantages. There were two good roadsteads, one sheltered from all winds, except from the north and east, and the natural configuration of the land would immensely facilitate the formation of a port. The trade of the port had great capabilities, and might be indefinitely extended, as large tracts of well watered land were lying fallow, owing to want of transport. The line which he should propose for the railway would be along the level country between the sea and the mountains, till, after passing the Nahr-el-Barid and Nahr-el-Kebir, they would reach a fertile plain. After about three miles of difficult work, where some engineering might be required, there would be a gradual ascent to the plains around Homo. Here the Orontes would have to be crossed, but a bridge sixty feet in length, with approaches on either side of about one hundred yards, would be amply sufficient.

He pointed out that while the cost of carriage for goods per mile by means of canal was at least 8d per ton, conveyance by rail would not cost one-third of that amount. Many branches of cultivation might be easily developed if good government could be secured and the capital lying idle in the country, which must be very large, employed. The whole distance between Tripoli and Aleppo was 197 miles, and the distance as the crow flies 165 miles. From Aleppo to Alexandretta was 97 miles farther, in the course of which the Beilan Pass would have to be crossed, at a vast expenditure of time, labor and money. Probably this work would cost as much as the whole of the rest of the line from Tripoli to Aleppo, and would probably occupy eight or nine years. The total length of the line would be 340 miles. Nothing would have such important political and commercial results as this line, than which no line of such length and importance possessed so few physical difficulties to be overcome, and presented so great a prospect of financial success.

At the concluding meeting it was announced that the grants of money appropriated to scientific purposes by the General Committee amounted to £960. The following is a list of the grants: A. Mathematics and Physics—Dr. Lodge,

new form of high insulation key, £10; Prof. Adams, standard of white light, £20; Prof. Everett, underground temperature, £10; Dr. Joule, determination of the mechanical equivalent of heat, £50; Sir W. Thomson, elasticity of wire, £50; Mr. Glaisher, luminous meteors, £30; Mr. G. H. Darwin, lunar disturbance of gravity, £30; Prof. Sylvester, fundamental invariants, £50; Mr. J. Perry, laws of water friction, £30; Mr. W. E. Ayrton, specific inductive capacity of Sprengel vacuum, £20; Rev. Prof. Haughton, completion of tables of sun-heat coefficients, £50; Prof. G. Forbes, instrument for detection of fire-damp in mines, £10; Mr. J. M. Thompson, inductive capacity of crystals and paraffines, £25. B. Chemistry—Dr. Dewar, spectral analysis, £10; Dr. Wallace, development of light from coal gas, £10. C. Geology—Prof. Duncan, R. M., report of carboniferous polyzoa, £10; Prof. A. L. Adam, caves of South Ireland, £10; Prof. Seeley, viviparous nature of ichthyosaurus, £10; Mr. John Evans, Kent's cavern exploration, £50; Mr. John Evans, geological record, £100; Prof. W. C. Williamson, moicene flora of the basalt of North Ireland, £15; Prof. Hull, underground waters of Permian formations, £5. D. Biology—Dr. Pye Smith, elimination of nitrogen by bodily exercise, £50; Mr. Lane Fox, general anthropological notes, £20; Mr. Stainton, record of zoölogical literature, £100; Dr. M. Foster, table at zoölogical station at Naples, £75; Dr. A. Gamgee, investigation of the geology and zoölogy of Mexico, £50; Sir J. Lubbock, excavations at Port Stewart, £15. F. Statistics and Economical Science—Dr. Farr, anthropometry, £50. G. Mechanics—Mr. Bramwell, patent laws, £50. Total, £960.

SCIENTIFIC MISCELLANY.

CHEMICAL COMPOSITION OF MINERAL COAL.

ABRIDGED FROM "COMPTES RENDUS" BY PLINY EARLE CHASE, LL. D.

For nearly thirty years Prof. E. Fremy has been studying vegetable tissues, with especial reference to the chemical nature of the principles which they contain, and the influences which have changed them into lignite, bituminous coal and anthracite. He began with examining the vegetable skeletons. The substances which he first studied were almost wholly unknown; their characteristic property is their production, under the influence of a ferment or of reagents, of gums and gelatines. He showed that they are all derived from a primitive insoluble compound, which he called *pectose*, represented in its greatest simplicity by the formula $C_8H_5O_7$, and which, by successive polymeric transformations, forms at first gummy substances, then gelatinous bodies, and finally an acid soluble in water.

He then began the study of the stable elements which form the fibers, cells

and vessels. He found that the vegetable frame-work is not so simple as he thought; it is not built of simple cellulose, differently incrusted by other substances, but of many kinds of isomeric cellulose. There is also, in nearly all parts of the skeleton, a very important body, which differs from the celluloses in composition and properties, which abounds in the vessels, and which he therefore calls *vasculose*. The proportions in which it exists in different kinds of wood affect their physical qualities. Oak may contain 30 per cent; in walnut-shells there is sometimes 50 per cent. It binds the woody fibers together. Caustic alkalies dissolve it, and they are therefore employed in the manufacture of wood paper.

After ascertaining the composition of the internal tissues, he analyzed the cuticle and other coverings, discovering *cutose*, which is well fitted, by its resistance to chemical change, for protecting the parts which are exposed to the air.

Passing, next, to the bodies which are most often found in the tissues, he showed that gum is a true salt of lime, and that chlorophyll owes its green color to a salt of potash.

In extending his studies to combustible fossils, he first sought what chemical differences characterized wood, peat, the different lignites, bituminous coal and anthracite. He found that wood is not sensibly attacked by a dilute solution of potash, while peat often yields to that alkali considerable quantities of ulmic acid; xyloid lignite, or fossil wood, still contains notable proportions of ulmic acid, but it is easily distinguished from wood and peat, because it is changed into yellow resin by nitric acid and it is completely soluble in hypochlorites; compact or perfect lignite contains no appreciable ulmic acid, and still it is dissolved in nitric acid and the hypochlorites; as to the true coals, they are characterized by their insolubility in neutral solvents, acids, alkalies and hypochlorites.

In his synthesis, he was guided by the experiments of Daubree and Baroullier, which indicated the importance of heat and pressure in coal metamorphosis. He performed a series of experiments, in which vegetable tissues and the substances which most often accompany them in organization, were separately kept, for a considerable time, at temperatures ranging from 200° to 300° (392° to 572° F.), in hermetically sealed glass tubes. He found that cellulose, vasculose and cutose all became black, brittle, yielding water, acids, gas and tar, but preserving their organization; they did not melt, but gave a fixed product which showed no resemblance to mineral coal. With sugar, starch, gum, chlorophyll and the fatty and resinous bodies which accompany it in the leaves, the results were very different. By long calcination under pressure they became black, shining, often melted, absolutely insoluble in the tested chemicals, and very different from charcoal, for when heated to redness they behaved like organic bodies, yielding water, etc., but having, as a fixed residuum, a hard and brilliant coke. The chemical resemblance to a specimen of Blanzy coal, which was analyzed by Renault, is thus shown:

	Carbon.	Hydrogen.	Oxygen.	Ashes.
Coal from sugar	66.84	4.73	28.43	
" " starch	68.48	4.68	26.84	
" " gum arabic	78.78	5.00	16.22	
Blanzy coal	76.48	5.23	16.01	2.28

He was induced to experiment on these three substances because, according to Ad. Brongniart, they must have abounded in the vegetables which produced the coal beds, and because gum often comes from the transformation of tissues, as Trécul has shown.

Further experiments led him to the dominant hypothesis that vegetables are first changed into peat, and that, in that form, the disappearance of the organized tissues is due to a kind of turfy formation, as Van Tieghem suggested. He then operated on three kinds of ulmic acid: 1, acid which he had himself extracted from peat; 2, saccharumic acid, which he obtained from M. P. Thenard; 3, ulmic acid extracted by treating vasculose by alkalies. They were all transformed into substances similar to the foregoing, under the combined influences of heat and pressure, as is shown by the following analysis:

	Carbon.	Hydrogen.	Oxygen.
Coal from peat acid, heated 24 hours . .	67.48	5.84	26.68
Same, heated 72 hours	71.72	5.03	23.25
" " 120 "	76.06	4.99	18.95
Coal from vasculose acid	76.43	5.31	18.26

Finally, he examined the modifications, under heat and pressure, of mixtures of chlorophyll with the fatty and resinous bodies which alcohol extracts from leaves. Although the mixture was at first soluble in alkalies, after 150 hours' treatment it gave a black substance, viscous, insoluble in caustic alkalies, and presenting an evident analogy to natural bitumens.—*Journal of Franklin Institute.*

MINES OF CUSTER COUNTY, COLORADO.

BY J. K. HALLOWELL.

Having had to visit Silver Cliff within the last few days, I took time to look around, and observe what was to be seen in this second Colorado marvel of the past year. It is a pleasant drive of seven miles from Rosita through the foothills, and across the slightly rolling elevations of the Wet Mountain Valley. Viewing it as you approach, it reminds you of a toy village set upon a green carpet, or to make the simile more familiar, a new Kansas railroad town. Some say it is dull now, and perhaps it is to what has been, but let us go back a little in its history which is so recent that it is not much of a task to learn it, or write it. One year ago in July the first prospectors commenced going there, walking there and back from Rosita, and carrying tools between the two places to be sharpened. It is situated in the middle of the valley, two miles from Grape Creek, and having a single elevated cone or mountain, (Round Mountain,) a mile or so north. The find was hornsilver, picked specimens assaying as high as 1400 ounces silver, and one car load gave a mill return of $8000. One year ago now the whole thing could have been bought for $1000, and nine months after the discovery half of the Racine Boy claim sold for $204,000 cash, or equal

to $400,000 for the whole claim. The whole rock runs in silver, (chlorides,) and is a free milling ore. The cliff that this claim is situated upon juts up from the roadside about forty feet, and extends from that almost level. Experts on whose report the last sale was made estimated the whole rock, to breast it out and mill the whole product, without any sorting would give twenty-two ounces silver per ton. The surface of a claim is 300x1500 feet, and forty feet of it is in *sight*. This gives 18,000,000 cubic feet in sight. Allow fifteen cubic feet per ton, which is a big allowance, and we have 1,200,000 tons of twenty-two ounce rock, equivalent to $26,400,000 which can be mined, milled and reduced to bullion at a cost of $5,00 per ton at the outside. Figures won't lie, but that is a tremendous result, and even at a discount of fifty per cent. on the product there is profit enough in sight for even the $10,000,000 stock company that are the present owners. Is it any wonder that a town of 5000 people was built in less than ten months at that spot? A railroad from Cañon City has been surveyed to it, and a contract already let for water-works. Nor is the Racine Boy the only mine, but the Hornsilver, the Plata Verdel and others of less note are claiming attention, to say nothing of Johnny Bull and Domingo and mines three miles north which are a marvel.

The first visit was made to the sampling works of Messrs. Dillingham & Co. which are a model of neatness and simplicity. Their business does not require any very large plant, merely a crusher and rolls, with the necessary steam power. But it does require accuracy, care and honesty, and this reputation Messrs. Dillingham & Co. have in the highest degree. The ore is sampled when received, and paid for, the same as a wagon load of grain would be after weighing. After which it is crushed, by their machinery, all mixed together and shipped to Omaha and St. Louis smelting and refining companies.

Returning from their works to dinner, we paused a few minutes near a busy scene, namely where the excavation was being made for the foundation of the 40-stamp mill of the Racine Boy Mine. Some sixty to seventy men are at work in the excavation, and on the timbers surrounding the same, giving every promise that the new company mean business, and that in less than sixty days time, the machinery now on the way will be pounding away night and day, and turning an estimated quantity of seventy tons of hard rock into an impalpable mud.

Before reaching the hotel we took a turn over and into (partially) the Racine Boy claim; but a very few men are at work there now, waiting until their mill is ready, I presume. It is impossible to liken this formation to anything known, as it is not down in the books. No regular formation of ore-pipe, chimney or fissure vein appears, but an immense body of silica paste with the chlorides disseminated throughout the mass, and which in solidifying has no regular form of either crystallization or stratification, but has assumed all manner of curves and knots in its change from a fluid mass of wet paste, to its present solid form.

After a hearty dinner at the Powell House, we felt fortified for the three-mile tramp to the Granite formation north of Silver Cliff, wherein the Johnny Bull and Domingo mines are situated. These famous claims are on the one ore-body; much has been said about them, some shooting been done and an apparently interminable law-suit begun. This latter has fortunately been settled by a shrewd speculator getting both parties to name their price, and bonding the titles of all parties at the rate of a quarter of a million for the whole. On the way there we walked over several dikes of obsidian, and by the way there is natural glass enough there to supply all of the glass factories in the United States, if it can only be utilized. The change from the trachyte and porphyry to the granite is strongly marked, and so far, these mines are the only ones found containing pay ore, in the Granite-belt in Custer county. Obtaining permission to examine, we descended to a large excavation from which the ore had been extracted to a depth of forty to forty-five feet, sixteen feet wide and thirty feet long, the wall rock only appearing on one side, and composed of syenite. With that exception, above us, in front, on our right, behind, and under us was mineral, argentiferous galena, bright and sparkling, and lots of it. Taking a lighted candle and passing into one of the drifts, what a sight appears! From millions upon millions of crystallized facets the glimmer of our single tallow dip was reflected, until—well, in an old book wherein we all have read the story and thought it was a fable, and marveled at the richness of the imagination of the original narrator, is the description, but to what reader did it ever occur that Aladdin's cave was located in Custer county, Colorado, a natural and real fact in argent.

The mineral surrounds the syenitic boulders the same as in the Maine mine chimney at Rosita, but here it represents inches where there it represents lines. Two men here can sort as much ore as twenty-five there. A capping of ten to fifteen feet covers the ore on the surface, which is now being removed, and when done a body will be open for work of 30x60 feet surface, and now to a depth of thirty feet in the ore. If we were correctly informed as to mill-returns, there is $100,000 more in sight than the bond calls for, and how much below none can compute. Just try to imagine a cubical mass 30x60x30 feet, of which twenty-five per cent. of the bulk, and fifty per cent. at least of the weight was actual, solid mineral. After viewing this wonder of wonderful mines, we did not want to see any more prospects, but came straight back to the hotel, and it was a theme of conversation and authenticated computation, for my comrade and myself till long into the night. I dream of it yet by night, and in the day-time wonder where is the spot to dig for its like.

Now for a pertinent physical fact in geology, which probablay indicates what is below us here, and may be an index for future explorations: the Johnny Bull-Domingo mine, and the Maine or Bassick mine are both the largest chimneys containing as rich ore as is known in the world. The first is just about as far within the granite, as the latter is within the trachyte, on the same contact line, nearly east and west, and within seven miles of each other. Another fact to gen-

eralize from: nowhere on the face of the globe is there yet known such a rich mineral spot as a radius of ten miles from Rosita now shows. Within that distance we have every formation containing the precious metals known, viz.: chimneys, ore-pipes, fissure veins, rock deposits with minerals, and what might be placers. All of these show rich ore at or near the surface. From these facts, and the knowledge that nowhere have we penetrated to a greater depth on mineral than 250 feet, can any other deduction be drawn than that at some depth, and not more than 1000 to 1500 feet, we have immense and inexhaustible bonanzas yet to be opened and drawn upon for the world's uses. To my mind it is only a question of time and not long either, for Custer county, to become the first mineral producing county in the State instead of standing where she did last year, which if I remember aright was fifth.

GLASS FOR RAILROAD SLEEPERS.

Engineering, in a recent issue, gives the following details on railway sleepers made of glass toughened according to the De la Bastie process, which Mr. Frederick Siemens, of Dresden, a well known German manufacturer, and brother of Dr. William Siemens, is now introducing in England. Some of them have been laid on the line of the North Metropolitan Tramways at High street, Stratford. The sleepers in this case are of exactly the same section as the wooden longitudinal sleepers they have replaced, namely, rectangular, 4 inches wide by 6 inches deep, the upper side being molded so as to accurately fit the rails. They are laid in lengths of 3 feet, and to avoid the danger of settlement at the joints, beating plates 10 inches by 5 inches by 1½ are placed at these points, these plates being also utilized for effecting the securing of the rails by a fastening which obviates the necessity of molding any holes in the glass. The samples of the sleepers above mentioned have been tested by Mr. Kircaldy, and their average breaking weight, when resting on supports 30 inches apart, has been found to be about five tons, this being probably about two-thirds of the resistance which would be afforded by a good pine sleeper of similar dimensions. It must, however, be borne in mind that whereas the timber would become depreciated by use, the glass promises to be practically indestructible by moisture, etc.

At the works of Mr. William Henderson, a plate of Mr. Siemens' toughened glass 9 inches square by 1⅛ inch thick, imbedded in gravel ballast 9 inches deep, and having on its top a wood packing ⅛ inch thick and a piece of rail, was subjected to the action of a falling weight, the blows being delivered on the rail. The weight was 9 cwts., and blows were successively delivered by letting this weight fall from heights of 3 feet, 5 feet 6 inches, 7 feet, 10 feet, 12 feet 6 inches, 15 feet, 17 feet 6 inches and 20 feet. Under the last mentioned blow the rail broke, the glass, however, being uninjured. As a higher fall could not be obtained and a greater weight was not available, a smaller section of rail was sub-

stituted for that previously employed, and the glass was broken by a second blow of the 9 cwts. falling 20 feet, the plate being driven through the ballast into the hard ground. A cast iron plate 9 inches square and ½ inches thick, tested in a similar way, broke with a blow from the 9 cwts. weight dropped 10 feet.

The cost of the toughened glass is stated to be about the same per ton as that of cast iron, but as its specific gravity is only about one-third that of iron, the cost of any article of given dimensions, is, of course, materially less. The material has as yet been too recently introduced, and too little is known of its characteristics to enable any very decided opinion to be formed as to its future capabilities; but the results of the experiments so far made with the material are certainly of an exceedingly promising character, and the further development of its applications will be watched with much interest.

BOOK NOTICES.

Coal Flora of Pennsylvania and of the Carboniferous Formation Throughout the United States. By Leo Lesquereux. Large octavo; atlas of 87 double plates and text in separate volumes. Published by the Board of Commissioners of the Second Geological Survey of Pennsylvania.

This is one of the most valuable reports issued by any of our State geological surveys, and reflects honor alike on the author, the State of Pennsylvania, and American science. The plates are finely executed, illustrating 398 species of plants (about 1,200 figures), of which nearly two-thirds are now for the first time described as new species. These illustrations are largely from the Carboniferous deposits of Pennsylvania, but when peculiar species from other parts of the United States supply some forms not found in that State, they are here described and illustrated. The work thus becomes what its name implies, the Coal Flora, including, in text at least, a full description of all the types of the luxuriant vegetation of that important geological age. Notwithstanding the large number of plates and figures, nearly one-half of the new species are described without them, though illustrations are very necessary for a full understanding of the specific traits. We hope, therefore, that Pennsylvania will authorize the publication of another volume of plates.

This work, with Prof. Lesquereux's Tertiary Flora (1878) and Cretaceous Flora (1874), together with his numerous other smaller publications and contributions to various State geological reports, have now given us a history of fossil botany in nearly all its stages. B. F. M.

Laboratory Teaching. By Charles Loudon Bloxam. Fourth edition. 261 pages. Illustrated. Philadelphia, Lindsay & Blakiston. For sale by M. H. Dickinson. $2.00.

This work is for use in the chemical laboratory by those who are commenc-

ing the study of practical chemistry, not pre-supposing any knowledge of chemistry by the student, and not indulging in any theoretical speculations.

As long ago as 1853 Prof. Bloxam, then the first assistant in the Royal College of Chemistry, London, published a Hand-book of Chemistry, which met with the approbation of the distinguished chemists of the day, and also met with decided success. Since then he has succeeded to the chair of chemistry in King's College, and has written several works on the same subject.

This volume is in its fourth edition, and has received all the alterations required in nomenclature, formulæ, etc., to bring it up to the standard of present teachings. In other respects it is practically unchanged from the first edition. Among its excellences we may point out, first a series of simple tables for the analysis of unknown substances of all kinds except organic bodies. Second, a brief description of all the practically important single substances likely to be met with in ordinary analysis. Third, simple directions and illustrations in chemical manipulation. Fourth, a system of tables for blow-pipe work. Fifth, instructions for the purchase and preparation of tests.

One great advantage of this work is that it dispenses with the use of costly apparatus and chemicals, thus enabling a student in the country to use it intelligently and readily. There are nearly one hundred illustrations, which, with the clear and precise style of the author's directions for working, will make the book just what the student needs.

SUMMER AND ITS DISEASES. By James C. Wilson, M. D. 160 pages, 12mo. Lindsay & Blakiston, Philadelphia. Cloth, 50 cents.

This is Vol. III of the American Health Primers issued by the above named well known medical book publishers, and though received rather late it will be found to contain many valuable things for the guidance of readers in the late summer and fall months. Its author, Prof. Wilson, is Physician to the Philadelphia Hospital, and as such has had a wide experience in every department of medicine. His manner of handling the various topics under consideration is clear and popular and his directions common-sense and practical.

Sunstroke and Heat Fever; Summer Diarrhea and Dysentery; Cholera Infantum; Summer and Autumnal fevers; Summer Colds and Hay Asthma; the Skin in Summer and its Diseases are the titles of the chapters which if carefully examined will be found to contain the information most needed for "the heated term."

THE CRUISE OF THE FLORENCE. Edited by Capt. H. W. Howgate, U. S. A. 183 pages. 12mo. James J. Chapman, Washington, D. C., 1879.

A very pleasantly written narrative, made up from the Journal of Capt. Geo. E. Tyson, who commanded the preliminary *Arctic Expedition* of 1877 and 1878. Without more than touching upon the scientific work of Professors Sherman and Kumlein this narrative gives a graphic account of the labors and hardships of the members of the expedition, the novelties and discoveries made and experienced

and the value of the regions visited to the trade and commerce of the world when developed. Once commenced, no reader will lay the book down before having finished it in full.

OTHER PUBLICATIONS RECEIVED.

Contributions to the Natural History of Arctic America by Ludwig Kumlien naturalist of the Howgate Polar Expedition of 1877-8. Daily Programme of the 28th Meeting of the American Association for the Advancement of Science, at Saratoga Springs, N. Y. Ninth annual Report of the Trustees of the Waterworks of Columbus, Ohio, for year ending March 31, 1879. Bulletin of the U. S. Geological and Geographical Discovery, Vol. V, No. 1 Radiant Matter, a lecture delivered by Prof. Wm. Crookes, F. R. S., Aug. 22, 1879, before the British Association for the Advancement of Science. Wonders of Light and Color, by Edwin D. Babbitt, New York.

EDITORIAL NOTES.

Dr. Edwin Babbitt, of New York, sends us a pamphlet entitled, "The Wonders of Light and Color," including a treatise upon Chromopathy, or the new science of color healing, with reports of numerous cases of different diseases cured by him and others by the use of variously colored medicines and substances. The principles enunciated are in accordance with recognized science and the experiments are worthy of repetition by those suffering similarly. Price 25 cents.

Our former friend, *Sunday Afternoon*, comes out in a new medieval kind of cover, and with the new title *Good Company*, but from an inspection of its contents we do not find the company any more or less agreeable than before, thus verifying the statement that "a rose by any other name," etc.

The *New York Medical Journal* for September, contains, among many valuable articles one on the Advantages of Cold Climates in the treatment of Pulmonary Consumption by Dr. Talbot Jones, who, forcibly sets forth the value of Minnesota as a health resort.

We are again indebted to Prof. William Crookes, F. R. S., London, England, for a marked favor, in the shape of an advance copy of his able and most interesting address before the British Association for the Advancement of Science, delivered at Sheffield, August 22, 1879, upon Radiant Matter, a subject to which he has devoted more time and study and achieved more brilliant results than any other living scientist.

At the next regular meeting of the Kansas City Academy of Science, the programme for the winter will be arranged. It is probable that a course of popular science lectures by some of the most distinguished professors in the west, interspersed with papers by resident members of the Academy, will be determined upon and provided for. Such courses have proved very entertaining and successful in other cities and doubtless will be as highly appreciated here.

We were much gratified last week by a visit from the veteran geologist of Kansas, Prof. B. F. Mudge, who was on his way to Lawrence to deliver his semi-annual course of lectures upon Palæontology before the students of the Kansas University.

We are indebted to Professors Putnam, Kedzie, Ingersoll, Bolton, Lovewell and others, for programmes, items and personal reports with regard to the proceedings of the American Association for the Advancement of Science, at Saratoga, last month. The newspapers of Saratoga contained only meager reports, very far inferior to those of the St. Louis dailies last year.

As will be seen by reference to page 353 of this number of the REVIEW, Prof. John H. Tice predicts the occurrence of an unusually copious shower of meteors on November 13th, and calls upon all observers to note whether or not his predictions are verified.

THE U. S. Entomological Commission, of which Prof. A. S. Packard, Jr., is Secretary, has issued a circular of inquiry into the existence and habits of the Hessian Fly in the west, and desires especially to ascertain the extreme western limits of its operations in Kansas, Nebraska, Minnesota and Dakota. Any of our readers having information on this subject will be of service to the country by communicating to Prof. Packard at Providence, R. I, any facts observed by these relative to the date of the appearance of the fly in Spring and Autumn, the date of its assuming the "flax-seed state," the number of broods annually, which varieties of wheat are least attacked by it and what other cereals and grasses are infested by it; statistics as to abundance and losses in their county, best preventives, etc., are very desirable.

PROF. J. D. DANA, of Yale College, writes as follows relative to Prof. Mudge's recent article on "Birds not derived from Dinosaurs":

NEW HAVEN, CONN., Aug. 31, 1879.

Dear Sir:—I have received the August number of your REVIEW, and think that Prof. Mudge is right in saying that the demonstration that birds came from Dinosaurs is far from complete, that there are more wide differences than close resemblances. To a *believer* in evolution, the demonstration is satisfactory, and, he says, complete, because with him it is only a question as to the line of descent; but one who questions the descent, may rightly demand far better evidence before admitting the conclusion. The weak point in the evidence *against* evolution, from the wide gaps, consists in the fact that almost nothing is known of the terrestial vertebrate life of the Mesozoic, especially the birds and mammals. Yours truly,

J. D. DANA.

A WORK of great value for reference to all book-buyers, book-sellers and book-makers, has just been issued by HOWARD CHALLEN, of Philadelphia, comprising all new books published by upward of four hundred publishers, arranged alphabetically, by subject, so that any new book on any topic can be ascertained, any new book by any author, and also by the title, with the price and publisher. The present issue embraces books issued from November 1878 to June 1879.

A supplement is in preparation of all books to November, 1879, with an Alphabetical Dictionary of all American and English Journals, arranged under subject or specialty, so that any Periodical, as well as any new book in any department of literature, can at once be ascertained.

PROFESSOR ERNEST INGERSOLL has been engaged for the U. S. Fish Commission and the U. S. Census Commissioner in a study of the natural history and economic value of the oyster.

PROFESSOR WILLIAM H. WAHL, of Philadelphia, associate editor of the *Engineering and Mining News* published in New York City, writes August 5th as follows: " * * * I take much pleasure in reading your REVIEW, and trust that you are succeeding with it."

THE article entitled "To the Young Men of Missouri," recently published in the Kansas City *Times*, was written by Dr. Wm. Fort, of Randolph county, Missouri, and contained many points of interest to the class to whom it was addressed. Dr. Fort is now 86 years old and was for over thirty years, prominent in State affairs.

IT is gratifying to observe our Missouri teachers are receiving due recognition and appreciation in other States. The latest case of this kind that has come to our notice is that of Prof. T. Berry Smith, who was last year in Pritchett Institute, Glasgow, Mo., and who has recenily been elected Professor of Chemistry and Physics in Carleton College, at Northfield, Minnesota.

Mr. Henry Cabot Lodge, one of the new editors of the *International Review*, contributes to the September number a review of the life of Secretary of the Treasury, Albert Gallatin—a life which marks as important an era in the financial history of the United States as that through which the nation is now passing. Mr. Philip Gilbert Hamerton begins his article on Rubens in the same number.

The Sanitarian for September, as usual, abounds with seasonable articles: the first is "The Education of Girls, as Connected with their Growth and Physical Development," by Nathan Allen, M. D., LL.D., which should not only be read by all educators, but by all parents who would appreciate the importance of physical and mental culture, and their just relations to each other in both the school and the family. Dr. Allen is well known to be among the foremost in social science studies generally, but in relation to the subject which heads this contribution he stands pre-eminent; and he has brought to bear upon it an amount of learning and practical knowledge of the utmost importance to the rising generation, which no educator who takes pride in his profession can afford to do without. Liernur's New System for Keeping Cities Clean, elucidated by diagrams and drawings, translated and commented upon by Dr. Laung, of New Orleans, should be read not only but studied by all sanitary engineers and others interested in the subject of sewerage disposal. Dr. Laung especially commends this system for New Orleans, but it is equally adaptable and no less necessary to other American cities; above all, to several of our Southern and Western cities, which, as yet, have adopted no plan consistent with health, and where the authorities have the advantage of investigating this means in the light of the numerous failures and dangers of other systems. True economy consists in the adoption of the best means for the protection of the public health. Those who would pursue this policy should study well this presentation of the admirable method of Capt. Liernur.

The Atlantic, for November, will open with the article postponed from the October number, on our Army and Military Organization, which will be of great value and interest. The closing chapters of Irene the Missionary will be given, and there will be two short stories, one by the author of Massy Sprague's Daughter. The number will be particularly rich in matters of literary interest, while on the side of politics and social discussion it will be fully sustained.

A perusal of the *Contributions to the Natural History of Arctic America*, by Ludwig Kumlien, naturalist to the Howgate Polar Expedition of 1877-8, shows that the animal life of those regions is very abundant, and that unfavorable as were the conditions on the Florence during her cruise and winter stay, Prof. Kumlien labored diligently in searching for specimens of characteristic animals, plants and minerals and was exceedingly successful.

The contents of *Harper's Monthly* for October are as follows: On the Skirts of the Alps.—Col. Geo. E. Waring, Jr., with ten illustrations; Painted Glass in Household Decoration.—Charles A. Cole, with nine illustrations; The Connemara Hills.—Miss J. L. Cloud, with seven illustrations; Fifty Years of American Art, III.—S. G. W. Benjamin, with sixteen illustrations; A Ramble in Central Park.—Helen S Conant, with thirteen illustrations; The Two Burdens, (a poem).—Philip Bourke Marston, with two illustrations; Through Texas.—Frank H. Taylor, with seventeen illustrations; White Wings: (a yachting romance).—William Black, with two illustrations; The State of the Alchohol Question.—Dr. Titus M. Coan; Belle's Diary, (a story).—Mary N. Prescott; Young Mrs. Jardine, (a novel).—D. M. Craik, with three illustrations; The Revolution in the Life of Mr. Balingall.—Sherwood Bonner; Mary Anerley, (a novel).—R. D. Blackmore; Editor's Easy Chair; Editor's Literary Record; Editor's Historical Record; Editor's Drawers.

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POLITICAL SCIENCE.

ARE THE INDIANS DECREASING? IF SO, WHY?

PROF. B. F. MUDGE, MANHATTAN, KANSAS.

The growing interest in the condition of our aborigines, and the lack of critical information concerning their numbers and progress in civilization, must excuse an article on this subject. As an evidence of our lack of knowledge of the situation of our native tribes, we cite the conflicting opinions in relation to their increase or decrease in numbers. The old, prevalent idea that they are decaying is contradicted, and we are told by those who assume to know, that they are increasing in population. Equally diverse are the opinions as to their progress in civilization.

As the first question is one of figures and statistics, we should expect that there would be no great discrepancy in the statements of the various writers. The disagreement on this point is caused by the difficulty in obtaining the actual numbers of the wild tribes, and also in the hasty statements of popular writers. Let us see how the best statistics, official and otherwise, will settle this question.

Geo. Bancroft, in his History of the United States, places the whole number east of the Mississippi, at the first settlement by the whites, at 180,000. This is lower than the estimate of any other writer. Boquet, who traveled extensively among them in 1764, gives their number at that time, after many severe wars, at 283,000, in the "old colonies." By this term he included all the country claimed

by the French and English in Canada and Florida, as well as the thirteen colonies. Others, who had good opportunities to obtain information, estimated the original number at 300,000. If we take the lowest figures, those of Bancroft, we shall still see that the tribes formerly in contact with our ancestors have decreased, so that we have not more than one-fourth as many now living as the original number. Whole tribes have entirely disappeared. Others are represented by a few dozens of mixed breeds, without a full blooded Indian among them. Still, others, like the Cherokees and Creeks, have decreased very slowly.

If we take a few tribes and trace their separate history, this decay will be more clearly impressed. Thus, the Wyandottes were one of the powerful tribes when the whites first settled near them. In 1855 they had decreased to 554. In 1861, when the writer lived on their reservation in Kansas, they were less than 500. Of this number, not more than half a dozen were full blooded Indians. The latter were aged members of the tribe and have since died, so that now, there is not a full blooded Wyandott living. The census of 1875 gives the number of the tribe at 247, many of whom could pass as whites.

The Delawares afford another instance of a tribe which had been in contact with our race for over two centuries. The American Encyclopædia states that at one time they numbered 40,000. This probably included some tribes that were subsequently known under a different name. In 1855, the U. S. Report gave their number at 25,00. In 1861, when the writer first became acquainted with them, their official *annuity* number was 1,054. Of these, less than one tenth were of pure Indian blood. The U. S. Report of the Department of the Interior, in 1875, gives the number associated as a tribe, as only thirty. Some had probably gone to other tribes, and about a hundred of the whitest portion had become citizens of Kansas, most of whom pass as pure whites.

In considering the population of any tribe, one custom, universal among all the aborigines we have met, must be kept in mind, namely: that when a white man marries a squaw, he is counted as one of the tribe, and enjoys all the privileges of an Indian, even to his share in the annuities from our government. This was clearly illustrated in the portion of the Sacs and Foxes settled in Iowa. In 1873, the annuity was divided among three hundred and seventeen nominal members, while only eighty belonged to the two tribes, and many of these were of mixed blood, and quite a number "dissolute whites;" so that, not only the half-breed children, but even the white fathers are counted as Indians. This makes the apparent number greater than it should be, as half-breeds should in the census be divided between the two races.

The southern Indians, as the Cherokees, Choctaws, Creeks, &c., present a more favorable condition of affairs than the northern tribes. They were originally more civilized than any others this side of Mexico and the Rocky Mountains. They cultivated more ground, had better houses and more native domestic arts than other Indians. Their numbers, reported at different periods, are more reliable.

The Creeks, when moved west, in 1832, were found by the officials to count 22,668. The official report of the Indian Departmant for 1857, gave 14,888, and that of 1872 gave 12,295. This shows a steady decrease, although all the half-breeds and many of the unmixed Indians had quite extensively adopted civilized habits. As early as 1832, they had so far conformed to our morals (?) as to own nearly one thousand slaves. We met, recently, some of this nation in Texas, without suspecting they were "Indians" till informed of the fact. How many of the tribe are of mixed blood we could not learn, but probably one half. To the white blood is due most of the advance they have made in civilization. Schoolcraft says the Creeks commenced their advancement in agriculture, a century ago, under the Scottish admixture.

The Cherokees are frequently quoted as an instance of advancement in civilization. A few facts will show how much may be credited to white, and how much to Indian blood. Their number, when removed west in 1837, was 27,000. Schoolcraft estimated their number in 1847, at 26,000, (including about 2,000 in South Carolina, not among those removed); and Catlin, about the same time, gives 22,000 and adds, that there was a large proportion of white blood. We know from other sources that whites had intermarried with them before the revolution. In 1853 the government report gave 17,367 on actual count, but since that date the reports give only estimates from 10,090 to 18,000, which would indicate that the number embraced in the tribe, though previously decreasing, has not varied much in twenty-five years. Of the present number it is exceedingly difficult to ascertain how many are of mixed blood. An intelligent half-breed, in whose house we were kindly entertained, and who could read and write easily, in both the English and Cherokee languages, stated that the full blooded Cherokees were not over 800. This was endorsed by a white man who had lived among them. Others estimated the number at 6 or 7,000. As they were scattered over a reservation one hundred and fifty miles long, and the pure blooded Indians were very isolated, we could not tell who was correct. The white blood has evidently checked the decay of the tribe. We were informed that there were over 2,000 white men and women intermarried into their nation, and from the number we met, we were satisfied that this estimate was not too large. We saw at the Indian houses more whites than full blooded Cherokees. At the first sight, this intermixture would seem to show a want of taste in our race, but when we recollect that a large proportion of the tribe has but little Indian blood, and are well educated, the objections vanish. The greater portion of these whites are men of good morals, intelligence and education. Their houses are better than the average of our western settlers. That the whites and lighter mixed population take the lead in farming and in improvements is easily seen. When we saw a large, well tilled farm, with good houses, we could easily grade the degree of white blood in the owner. Some of the pure Indians do indeed till the soil in small farms, but we were informed that their women assist in the field, while the half-breed squaws do not.

The better comforts to be found in the houses of the whiter portions of the tribe is very favorable to the health and lives of the children. This becomes another element in the preservation of the race, at the same time increasing the percentage of white blood.

Other tribes might be designated in detail with like results. Some are passing away rapidly and others slowly, but no tribe east of the Rocky Mountains, which has had official relation with our government, or come in contact with the whites, has retained its original numbers. The writer has been on the reservations of eighteen tribes, and on some of them very frequently. He has met members of other tribes, and from personal observation, and the official returns of Indian agents, he finds all decreasing. Of fourteen tribes, in whole or in part, on reservations in the State of Kansas, at the time of its organization, the average decrease has been about one-half. The Sacs and Foxes have only one-eighth of the number returned in 1835. This decrease has occurred, too, when all the tribes have been on the most friendly terms with the whites and with each other. No wars have taken place during that time. There has never been any trouble between the State of Kansas and any of the Indians on these reservations. They have been treated the same as white men, and when they have adopted our habits of life, they have been allowed to vote at the election of town and State officers.

Concerning the number of wild Indians, distant from our settlements, whose only visitants are exploring parties, we know but little. No reliable, positive information, fixing their increase, is known. In a few instances, we have reports of local epidemics which have made sad work. The Mandans, in 1837, lost more than nine-tenths of the tribe, from small pox, in a single season. Catlin mentions several instances where thousands were cut off in other tribes, by this and similar diseases. So far as estimates can be taken, in relation to the great body of the wild tribes, the evidence shows a decrease more rapid where they are in close contact with the whites, and less rapid where there is least intercourse with our race. Catlin, who lived with the wild tribes about eight years, in part from official reports, and in part from estimates, gives their number, in all portions of the United States, in 1840, at 400,000. McCoy made it less, but he puts 20,000 as the number within the Rocky Mountains, which we now know, was much too low. These estimates were made before the annexation of New Mexico and California. Schoolcraft, in 1847, gives 388,229, specifying the number in each tribe, mostly by estimate, and adds, that there may be 25,000 or 35,000 more in the unexplored regions of the United States. This includes 92,130 Indians in New Mexico, 32 231 "California tribes," not included in Catlin and McCoy's statements. This total addition of 124,361 by annexation, enlarging the official returns from Washington, is probably the cause of the prevailing opinion that the Indians are increasing. Fifteen years later, the official government report for 1855, gives figures for 314,622, and adds that the number may be as high as 350,000.

The report of the Interior Department for 1875, most carefully made in all its details, gives a total census of 278,963, by "actual count," excepting 50,000, which are estimated. This, too, includes all the mixed races as Indians, one-half of which should properly be counted with the whites. These various reports, though there may be some errors in the estimates, make it evident that the Indian race is, and has been for three centuries, steadily decreasing.

How much of the wasting away of our aborigines is chargeable to the white race, and how much to other inevitable causes, is not easily defined It may be truly said, that if the whites had never come to this continent, they would have been as numerous as ever. Yet, it will not do to say that our race had no right to come here, for this would be to decide that the civilization of the United States is a crime. Must the progress and arts of 45,000,000 be kept back, that 400,000 uncivilized may live undisturbed? The great majority of the wars between us, and the wide spread introduction of intoxicating drinks, must be laid to the criminality of the whites. Still, much of this decrease must be due to the inevitable, irrepressible conflict between civilization and barbarism. Most savage races have a persistent indolence and opposition to all changes and any adoption of the mechanic arts. That the white race is heavily responsible for their decrease and much of their sufferings, is quite apparent. But their want of progress in civilization cannot be chargeable upon us. From the first connection of the French and English with them, they have been offered the arts most appropriate to their wants. The blacksmith and wheelwright have been common appendages to the Indian Agency. Missionaries and teachers of all phases of Christianity háve spent their lives to introduce our civilization and religion among them. Teachers have carried the spelling book and arithmetic; and the government blacksmith has offered to teach his art. But the Indian has made little progress in the first and scarcely any in the latter. The writer has had personal knowledge of about twenty-five tribes, some like the Cherokees, with a good reputation for progress, yet he has never found a full blooded Indian who had learned and practiced blacksmithing or any other handicraft so intimately connected with progress. This statemant is made after careful inquiries on the reservations, of teachers and agents. This we do not apply to the Indians of New Mexico and Arizona, as we have never been among them. They had a higher civilization before the whites came; raising cotton, which they wove into cloth, making good pottery and living in substantial houses. But they, however, show the Indian opposition to change; though they have domesticated our sheep and use the wool they weave their blankets, which are really a superior article, on their primitive frames, unwilling to adopt our more convenient hand looms. Their pottery is not different from nor better than that found in the ruins of their old villages, two or three hundred years old. Their houses are built on the same plan as when the Spaniards first saw them. Whether they have adopted the trade of the blacksmith, we do not learn.

This reminds us of a fact usually overlooked, viz: that the different families

of Indians varied much from each other in their domestic arts. The northern Indians, east of the Mississippi, raised corn, and some made pottery. Those between that river and the mountains, and extending to northern Texas, embracing the great Dakota family, had neither. Tribes adjoining, but belonging to different families, as Dakotas and Alonquins, each adhered to its own domestic arts. Even when an anomalous tribe, like the Mandans, had separated from its parent stock, and carried into new territory its original customs of log houses and large fields of corn, the surrounding tribes of a different family accepted neither. They showed the same aversion to adopt arts from each other that they have from the Europeans. The southern Indians wove cotton and the hair of different animals, but the northern Indians never learn to spin or weave, though their predecessors, the Mound-builders, made good cloth. This difference of original advancement in domestic arts, is closely connected with their rate of decay. Those families and tribes which had the least civilization, were the most rapid to decrease. The northern Indians have wasted the most rapidly; the southern tribes, the more slowly; while those in the southwest, who lived in towns, cultivated land by irrigation, made pottery and good cloth, have nearly retained their original condition. Even the best show so little disposition to improve, that Sparks said, twenty-five years ago, "No American Indian of unmixed blood, whatever pains may have been taken with his education, has ever been known to adopt the manners of civilized men, or to pass his life among them." If there have been any exceptions to this broad statement of the American biographer, they are so few that the fact is substantially sustained.

Why the Indian has not advanced, it is difficult to tell. Of his ability to do so, there can be no question. If he will apply as much industry and application to learn mechanic arts as he does in hunting and the cunning of war, he will succeed. The ability to compute numbers is considered one of the best proofs of intellect. Schoolcraft gives the numerals of several tribes whose systems go up as high as millions and trillions. If a tribe has no occasion to use numbers above a few thousands the ability to go higher is evident, when it retains a systematic computation which ranges far above any sums required in the ordinary or extraordinary affairs of life. All missionaries and teachers unite in saying that the young Indian of our mixed blood rapidly acquires a knowledge of arithmetic, as well as other branches of an education.

The greatest obstacle to progress is the inherent, constitutional indolence of the Indian. This natural trait, seen in all tribes, particularly those east of the Rocky Mountains, has been nurtured by the general custom of imposing all laborious duties on the women; even the cultivation of the ground appearing to have been their exclusive work. His pride looks on labor as the appropriate duty of slaves and squaws. From our first knowledge of the history of the aborigines of the United States, in all places and in all tribes, hunting and war have been his only employments, and the dressing of skins, with husbandry, and the practice of the few mechanic arts known to them, have been the exclusive duty

of the woman. His native and fostered pride scorns to perform menial duties. This has been the most persistent trait of his character. Herding cattle, he sometimes accepts. But we doubt if there is an average sized farm among the Seminoles, Osages, Creeks or Cherokees, who are the most civilized tribes, which is cultivated by the labor of a full blooded Indian man. The half-breed frequently excuses his wife from the field, but the true Indian does not. This aversion to labor, we once saw strongly exemplified at the Oto agency. Government distributes cattle at regular intervals, but the Indians declined to kill and dress them. We saw the Indians stand around in stately dignity while the white men slaughtered the animals and skinned the carcases.

The Indians on the reservations have certainly made more advancement during the last twelve or fifteen years than ever before. It is possible that our missionaries, teachers and agents have learned more correctly the best methods of reaching their susceptibilities. Capt. R. H. Pratt reports good success in teaching the Sioux, of unmixed blood, who are held as prisoners in Florida and at Hampton. It is probable that too little attention has been given to first civilizing the women. In all tribes they have shown a desire to adopt the dress of white women, and accept many of our customs. They freely learn and talk our language, while the men do not. They exert more influence in the tribe and possess more of "woman's rights" than is generally supposed. These points were recently illustrated among the Pottawatomies. The "prairie band" of that tribe, composed largely of unmixed blood, have lived apart from the whiter portions, and resisted all attempts at innovation, and particularly the establishment of a school. After a failure, an old squaw told the missionary teacher that he had begun wrong. That he must go among the mothers, and with their consent, which could easily be obtained, the object would be secured. He followed the advice, went around to the mothers, and obtained their promises that the children should attend, and when the time came, the school was established and became a success. The women clearly see the advantages of civilization as their labors are relieved and their comforts are increased. Women in all ages, have gained more by the arts of civilization than men.

While hoping that the future of the Indians may be more progressive than in the past, the facts come strongly back to us that their progress during three centuries has been slow, and nearly all of that progression has been in the mixed portions of the race. The official reports of 1875 give a total number of schools among them of 329, of which the Cherokees have 70, or nearly one-fourth. A large portion of the remainder are in the tribes long subdued and much mingled with the blood of the white race. Still it is the duty of our government, as we have taken their lands, to do everything possible to prevent their extinction or decay, and make every effort to give them the advantages of a civilized christianity.

BRITISH IMPERIALISM AND THE AUTONOMIC RIGHTS OF RACES.

BY A. GREELEY, KANSAS CITY.

I. *State Papers of the Hon. Wm. M. Evarts on the Fisheries Question.*
II. *Speeches of the Rt. Hon. W. E. Gladstone, and Articles in the "Nineteenth Century."*
III. *Speeches of the Earl of Beaconsfield at the Mansion House and in Parliament.*
IV. *State Papers of the British Secretary of State for Foreign Affairs.*
V. *Papers in the Kansas City* REVIEW OF SCIENCE AND INDUSTRY, *by Dr. A. H. Thompson.*
VI. *Articles in the Kansas City "Journal."*
VII. *Articles in the London "Times."*

The period of decentralization which culminated in 1848, has been succeeded by a centralizing movement which has advanced with such accelerated force as to attract the attention of those who apply their minds to the problems of social science. This movement is only in accordance with the immutable law that governs all things, from the ever-varying forms of matter to the higher walks of human thought and impulse. Synthesis and analysis, building up and pulling down, joining together and distributing in a ceaseless round, obeying the law that is the very nature of things, and which has wrought out from chaotic darkness and silence, formless but teeming with tireless forces, this fair earth to be the home of man, glowing with beauty, vocal with music, and peopled with progressive beings whose capabilities know no limit.

Careful of matter, not a particle is lost. Not a blade of grass, not an atom of dust, not even a formless vapor, but in its new combinations contains the conditions of life, which may be called the complement of matter. Without both neither could exist, and it is this duality of nature that made what we call creation possible. Underlying all the forms of matter, teeming with restless life and all the processes of the mind, with their far-reaching analysis, is the law of progress. No change can take place without coming nearer perfection; no thought can advance beyond previous thought, without approaching nearer to ultimate, absolute truth; error is eliminated, and that which is pushed aside and destroyed becomes the *debris* of the ages.

Man, whether produced by creation or evolution, was a unity. Races were a subsequent growth, a result of the law of decentralization, necessary at the time, perhaps, for the expansion of the original family, but which must disappear, in the final result, the equality and re-union of the whole human family, which has long been the brightest dream of Philosophy and the most earnest hope of Religion.

Humanity is greater than man. Races, considered as such, are still less than man, and to them belong no rights; all that constitutes a race, and much

more, is included in the grand whole, as expressed by the first term humanity. Of all these rights, to the fullest extent every individual is an equal inheritor.

In political and social science, mankind must be considered as a whole, possessed of a common origin, and in the abstract positively and absolutely equal. It was so in the beginning, but with the principle of analysis, of decentralization, at work. As progress advances, the principle of unity prevails. Races will disappear, and the individual will be regarded as a part of the whole, and not of a mere section. By cutting the human family up into sections and drawing around them lines of demarcation, the errors of each would be perpetuated and intensified. It is only by contact, that error and wrong can be destroyed and truth finally prevail.

Two nations, but one people, standing in the very front of progress, the advance guard of humanity, are living examples of this doctrine. One of them, but an hundred years old, young, vigorous, aspiring and intellectual, has, within these few years, blotted out the distinction of race, that was her inherent weakness. The other, parent of this bright daughter of promise, with the accumulated wisdom of a thousand years, but yet with all the vigor of youthfulness, has stretched out her arms, until her rule embraces every race into which the human family is divided, planting among each, as soon as the people are fitted for them, the same institutions, the same nurture, that made her peerless daughter so glorious and so beautiful; and, reversing the order of the title of this paper, it is her Imperialism that I am preparing to consider.

Reference has been made to Christianity: that, according to the rule laid down in the New Testament, races should be preserved intact, without interference, their autonomy respected and preserved and their rights clearly defined by treaties and mutual agreements. Let me give this proposition a moment's consideration.

Jesus was a Jew—an inheritor under the laws of the Old Testament of the conquests of Joshua. Now how did Joshua treat the nations among which he came, as advised by Moses and Aaron, who professed to speak the words of God himself?

Was the autonomy of these races respected? The very reverse was the fact. They were cast out and destroyed, utterly and completely. The New Testament contemplates and teaches the same course, only the force is moral instead of physical. The New Covenant did not mean any less opposition to error, only the means used should be different. It was not contemplated to stand aloof from the nations, but to mingle with them. The command is clear and explicit: "Go ye *into* all the world and preach the gospel unto every creature." The wheat and the tares were to grow *together* in the field until ripe, when the tares should be burned with fire. Every tree that brought not forth good fruit should be hewn down and cast into the fire. The end was the same as that which Joshua wrought out, but the weapons were spiritual, not carnal. The destruction in the one case was men, in the other that which impels them. The whole general teaching of the

New Testament points to the time when error shall be destroyed, not by keeping aloof from it, but in that conflict of forces which is the visible manifestation that the law of progress is at work.

It will never do to judge of a whole by taking seemingly isolated parts. No one mind can comprehend even the events of its own time, and it would be utterly powerless to grasp the whole history of the past. But a single point in the march of ages is presented at once. It is assumed that there is a guiding hand, and that which seems to us at the time weakness and contradiction, which seems heartless and cruel, is in fact but part of what will be ultimately a perfect whole.

If we should judge Christianity by the thoughts and views of the disciples—their longing after rewards and honors, the betrayal of their Master, denying him in his extremity and forsaking him in his peril; if we take the Master himself, praying in Gethsemane that the cup, which was already full and pressed to his lips, might pass from his trembling hands; or in the agony of the cross, when he cried, "My God! my God! why hast Thou forsaken me!"—its perfection as a system would sink into nothingness, and the skeptic would indeed triumph.

Centralization is not common alone to the British Empire. Within the last twenty years this country has spent millions of lives, and thousands of millions of dollars, to preserve the Union intact and to blot out the distinction of race. True, state rights are yet feebly contended for, by a section of a party, but their doom is sealed, and the merging of the whole supreme governing power in the central government is only a question of time. In Europe the movement was given form and shape by Count Cavour, in the unification of Italy. What Napoleon indicated in 1805, and which he then thought it would take twenty years to do, was finally accomplished after more that fifty years. The old forms had to be broken down. All Europe had to be trodden as in a wine-press, by the iron heel of the man of destiny. The old crystallized forms of despotism had to be crushed to atoms. The people had to be taught that kings do not rule by divine right. The new elements had to assume form and take upon themselves perfect growth. Italy was then ready for the master mind of Cavour.

Bismarck followed in his footsteps, and the same tendencies of the age consolidated the German Empire. Why, then, should men wonder that England is confederating her colonies and arranging the boundaries of her Indian Empire? Why should there be surprise because she is marking out more securely and permanently the tracks and landmarks of her vast commerce, and drawing together, by the bonds of common interest, her far-reaching empire, upon which the sun never sets? In the vanguard of progress, she cannot do otherwise, and the moment she ceases to lead, her prestige will depart and her star will set in darkness and gloom.

In what sense is the English an imperial people, for the government is only the reflex of the will of the people, and Beaconsfield is only an agent who declares the will and obeys the behest of public opinion? The Jews gave the world faith and theology, the Egyptians science and architecture, the Phœni-

cians trade and commerce, the Grecians civilization and the arts, the Romans laws and jurisprudence, and the English civil rights and representative government, and not only have they given the world these, but they became specially the depository of all the rest. If a nation or a community excel in a particular thing, the comparison is always made with tho English. Any specialty in manufactures is forthwith compared with what the English have done in that direction. If Prescott or Bancroft writes a history, it is compared with Gibbon or Macaulay. Poetry that approaches Shakespeare or Milton is thought to approach perfection. So completely is England now the center of trade that Mr. Evarts, in his "Trade Relations," says that a San Francisco merchant must provide himself with English exchange in order to buy a bill of goods in China or Japan. Ask any whaling captain what money he uses in his three years' voyage to the out-of-the-way places of the world, and he will tell you "Exchange on England." How proud the manufacturers of this country were when they could, without any tariff being in the way, undersell the English in their own markets; and we do not forget that we, on our virgin soils, can produce provisions cheaper than she on her rent-burthened fields. She is imperial in this, that she opens her gates and invites the competition of all the world.

But the charge is made that she is aggressive; that her flag is in all lands; that she is absorbing territory in every quarter of the globe, and that the autonomy of the native races disappears in her presence, that they are pushed aside and trodden down.

Now, what are the facts? In planting colonies, the English people have ever been in advance of their government. We in this country, on national days, have a fashion of saying that the "Pilgrims" came in the Mayflower for conscience sake. Sometimes, when nothing harder can be said, some of the States are taunted with having been penal colonies. I shall not attempt to settle this dispute. But, for whatever cause they left England, they brought charters with them, conferring powers of self-government, of which our splendid institutions are but a larger, perhaps a more perfect growth. The French had the St. Lawrence and the Mississippi, the two largest rivers; the Dutch had the Hudson, next in importance. Both these nations planted the feudal system, instead of representative government, the last remnant of which was extinguished in Lower Canada in 1844. The representative form, the truly imperial government, has triumphed over all the others, pushed them aside and destroyed them, leaving only the fittest to survive and go onward to perfection.

In India the merchants and traders, the people, went first. They formed settlements, they built forts, they raised armies, they did, apparently, a world of harm; but the imperfect civilizations of Brahma and Mohammed had crystallized. The Shaster and the Koran were finalities. They admitted of no farther advance. "The laws of cast and the chains of creed" had to be broken, and this could not be done except by impelling a better and a stronger civilization against the old. That wrong was done, needless wrong and that which should not have been done,

no one pretends to doubt. That the people of India were badly treated, between the native princes and the East India Company, is not disputed. Mr. Burke's speeches at the trial of Warren Hastings have placed these facts forever on record.

The British government at length extinguished the power of the Company, and commenced in reality the task of governing India. An hundred years have worked great results. India is now governed to a great extent by means of the native princes, but their expenditure is reduced within certain bounds. Except in the Vale of Cashmere, they have no power of taxation, and so much has the ruler of Cashmere abused this power that the British government is about to purchase his rights, and so relieve the oppressed people. And slowly and gradually, but surely, industries are taking form. The principles of law and justice are being introduced. The people are protected, and the administration of these native princes is directed by an English resident at each court, and the whole of the people are being surely taught the meaning of law and order, instead of arbitrary rule and violence; and the time is rapidly approaching when the poor ryots of India will exercise the franchise as freely as the free born American citizen.

Trade is as free to the merchants of New York as to the merchants of Liverpool. The tariff of India is for revenue purposes alone, and the taxes thus raised are all spent there. The finest system of railways the world has ever seen is being built with English capital. And these wretched people, depressed and ruined by four thousand years of misrule, are rising up to the dignity of manhood.

Juggernaut is in ruins. The funeral pile will be lighted no more forever, to consume the living and the dead. The sacred Ganges no longer receives the living sacrifices of helpless age and wailing infancy. Caste is rapidly passing away, to make room for that equality which is man's birthright. Woman is emancipated; and, from the mouth of the Indus to Siam, from Cape Comorin to the Hindu Koosh, life and liberty and property are safer to-day than in our own hapless desolated South.

In her resistance to despotism, India is to-day Britain's strong right arm. When the iron-clads passed the Dardenelles, and the swarthy sons of India swarmed on the battlements of the Knights of St. John, the world beheld the spectacle of the descendants of the men who checked the career of the Macedonian conqueror marshaled to check the triumph of another Alexander, and to defend the homes of degenerate Macedonians. When Turkey, prostrate before the colossus of the North, besought the aid of Beaconsfield, British Imperialism granted the protection desired, only on condition that slavery should be abolished, that justice should be administered, and that taxation should be re-adjusted, so that the people should be no longer plundered.

In the treaty of San Stefano, Russia missed her opportunity. But how could she do for others what she has never done for herself? There is no fine-spun theory about this. The ruling class in Turkey had to be thoroughly crushed,

completely humbled, before they would have asked for help, before they would have consented to inaugurate these reforms. And thus, out of the seething flames of war, from the ashes of the dead, is arising the Phœnix of Progress.

It is too much to say that the evils attendant upon the British conquest of India overbalance the present good, and they are but the dust in the balance in view of that which, in the very nature of things, is in prospect. The gain is all to these downtrodden, crushed millions, and the loss was as much Britain's as theirs. Her best and bravest sons have laid down their lives in this old, historic land. There is not a resting place for the dead in all the islands of Great Britain and Ireland from the consecrated fane of Edward the Confessor, the British Valhalla, to the humblest God's acre, but in which may be seen tablets placed by loving hands in memory of those fallen on the blood-stained plains of the Orient.

In South Africa, from the Cape of Good Hope to Aden, and along the shore of the Red Sea to the mouths of the Nile, nearly one-third the circumference of the earth, British Imperialism stands face to face with the last stronghold of savage life. When Egypt, three years ago, asked the guaranty and protection of England for her occupation of what is known as the Somoli country, protection was promised on condition of two free ports being established opposite Aden. The effect of this is, that these free ports are fast becoming great centers of trade, where the ships and merchants of all the world may come on equal terms with the merchants and ships of England.

Particular stress is being laid on the Zulu war. Does any sane person suppose that the condition of the Zulus could have been improved without the power of Cettawayo being broken? The result of the war places the Zulus in a far better condition than they ever could have arrived at by their own exertions. I do not propose to enter into the causes of the war. The London *Times*, the ablest, the most earnest and most consistent supporter of Lord Beaconsfield's foreign policy, puts the defense of the Zulu war solely on the ground that Britain must protect her people, wherever in savage lands they may be found—a duty which from the time of her earliest colonies she has observed—and that, in the opinion of the Governor of Natal, war was inevitable.

Six months ago no Zulu could marry until he had killed his man in battle, and when he did marry his home, his wife and his cattle, all belonged to the king. When Cettawayo's power was finally broken, the poor creatures asked for a white king. This was denied them. They must be governed by their native chiefs; but they were told that a white man would be left with each chief, to teach him how to govern, and in the meantime they could marry when they pleased, and their wives and their homes and their cattle should be their own. In the war, the English suffered as much as the Zulus, and no one will dispute but that the advantage is all with the savages—families, homes, the liberty of their persons and the rights of property!

It took the British people a thousand years to grow up to the rights the Zulus have acquired in a single month.

In the title a reference is had to the press of this city, as typical of the press of this country. Grave misapprehension exists as to the status and power of what are called "colonies," or "dependencies," of the British Empire. They are not dependencies, but parts of a great whole. Within their particular spheres, the power of each government is supreme. This is fully exemplified by the answer Mr. Evarts received to his demand that the Fisheries dispute should be settled without reference to the Dominion government. He was told that this could not be done. That the rights to the fisheries belonged to Canada, and that the Imperial government could not touch them without the consent of the Dominion. These are not powers peculiar to this confederation, for New Foundland is not yet included in the Dominion. It is yet a separate province, and this so-called Imperialism declines to allow the treaty of Washington to override the municipal laws of this humble province in what was called the outrage of which Mr. Evarts complained.

With British Imperialism, the legislatures are supreme, and the treaty-making power is subordinate to them. In Britain, the power of the Executive has been carefully defined. The power and the privileges of the Peers have been defined and hedged in in many respects; but the power, the privileges and the prerogatives of the Commons, the people's branch of the government, have never been defined, and it is safe to say that while British Imperialism lasts they never will be. The British Empire is now in the full vigor of usefulness—blooming only to decay, unless it contains within itself that vitality which alone can make it keep pace with the progress yet to come. As she goes on, the trail of the serpent grows fainter and fainter; but if she stop and look backward, another will take her place. And then, will America be prepared for the task.

PHYSICS.

MAGNETIC SURVEY OF MISSOURI.

BY PROF. F. E. NIPHER, ST. LOUIS.

At a meeting of the St. Louis Academy of Science, held October 6th, the writer gave some of the results of his Magnetic Survey of Missouri. It is found that the lines of equal variation exhibit remarkable flexures, which are attributed to the influence of rivers. This confirms an observation made by Prof. Hinrichs in the previous year (1878).

Prof. Hinrichs had detected these irregularities during the previous year, but his stations were so few in number and so widely separated that he did not feel perfectly certain of the fact. The survey of Missouri was begun during the same year, but as we aimed to work up each section of the State thoroughly as we

went along, the work of the first year did not reveal these irregularities. During the past summer the work has been pushed south of the Missouri River, and the evidence on this point has been placed beyond all question.

The explanation which Prof. Hinrichs gives of these irregularities is contained in his "Theory of the Magnetism of the Earth," published in Copenhagen, in 1860.

His hypothesis is that the earth's magnetism is due to the motion (rotation and translation) of the earth in ether, thus giving rise to ether streams in the earth, and he then predicted that ocean currents, by virtue of the motion of the water, would, when properly directed, accelerate or retard the ether stream, thus increasing or diminishing the magnetic intensity. The same explanation he now applies to rivers.

My own explanation is as follows:

Without making any assumption in regard to the cause of the earth's magnetism, but assuming the existence of earth currents of electricity, they distribute according to well known laws, flowing in greatest quantity through the lines of least resistance. The magnetic needle tends to set at right-angles to the current, following the well known law enunciated by Ampere. Where the general direction of the moist river valley is at right angles to the normal position of the magnetic needle, the position of the latter is not changed. Where the river runs at right angles to the earth currents, no component of the latter is deflected up the river, and here, also, the needle assumes its normal position.

At Jefferson City, a line of stations running from a sand-bar in the middle of the river, back into the interior (to the southwest), showed the local effect of the river itself, and gave a change of ten minutes to the mile. The fact was also brought out that the lines of equal variation along the river at this point consisted of closed curves, or ovals. The form of these curves has not been determined. It is thought that valuable results could be reached by making a careful survey of any one of the river counties, making magnetic determinations every half mile. The work of the government surveyors would here be of great value, but for the fact that a large part of it has been done in such a manner as to make the whole entirely unworthy of attention.

Arrangements are now being made to study the earth currents direct. It being impossible to secure the proper conditions on telegraph lines, we intend to build short private lines, grounding the ends, and measuring the intensity of the currents which flow through. One mile of east and west line, and one of north and south line will be built at some river station, while another set of lines will be built on the high region to the south — probably at Springfield.

WASHINGTON UNIVERSITY, OCT. 10, 1879.

AERIAL NAVIGATION.

DIXON.

The science of Aërial Navigation has for many years perplexed the minds of aëronauts, not scientific men, but this perplexity need not be of long duration. A little reflection upon the principles which should govern the form of the vessel to be used, and the density of the atmosphere, would be sufficient to show its absurdity. When we consider the velocity which aërial navigation must attain, we can find no better illustration than the fish. Look at the velocity of the bird. Now, I may ask why does not the fish swim faster than the bird can fly? Because of the greater density of the fluid in which the fish lives. Then what is the difference between the density of air and water? Air weighs 31-100 grains to the cubic inch, while water weighs a little over 252 grains to the cubic inch. This is shown by the barometer at 30 inches, and the thermometer at 60° Fahrenheit. The difference between the density of these two bodies is over 251 grains. Now, suppose the fisn can swim eight miles an hour in the water, which becomes a resisting force to his fins, then how fast must it fly if it were placed in the atmosphere, to make the air a resisting power? Just the difference of the density of air and water multiplied by 8, the distance the fish would swim in an hour in water. This would give the speed of the fish in its aërial flight at 2,008 miles per hour. This is a mathematical demonstration which aërial navigation must approach before it can be made practical to overcome any current in the upper sea. If the vessel has not the power to sail by the compass and chart, of what use would be the ship? She *must* stem the tide. This calculation is based at the surface of the earth, but when we ascend 14,000 feet we find the density of the atmosphere only one-half the density at the surface. Then the speed of the ship would have to be increased to about 4,000 miles per hour. But aërial navigation need not be over 8,000 to 10,000 feet above the surface of the earth, which would only increase the speed to about 3,000 miles per hour.

How could human life be sustained at this velocity? Now, if we can obtain this velocity, then we must build a vessel somewhat in the form of the fish, and so equally balanced and buoyant as to float in the atmosphere at the surface of the earth. About one-third or more of the upper portion of this boat must be capacitated to hold gas sufficient to float it when laden. This will correspond with the air-sacks in the back of the fish. Now, with sufficient power to drive the fins and direct the rudder of the ship, we are ready for our journey. Starting from Topeka, Kansas, St. Louis, Cincinnati, and Pittsburg would only be flag stations on the line to New York. Then Paris, Constantinople, Canton, and San Francisco, then Topeka again; the journey of a day.

When a velocity has been attained that will overcome the upper currents, and the physical man can endure it, then we may expect a new era in the world's history. But where are Donaldson, Colgoove, and Wise? Their fate, with that of many others, prove the folly of aërial navigation with the balloon.

ENGINEERING.

GEOGRAPHICAL ENGINEERING—ANCIENT AND MODERN.

Inundating the deserts of Sahara and Arizona, piercing with ship-canals the Isthmuses of Suez and Darien, changing the course of the Oxus from the Aral to the Caspian Sea; these are what a writer aptly calls geographical engineering. That the completion of these undertakings will work important geographical changes is very true, but that geographical engineering is something characteristic of the boldness of modern enterprise, as the writer in question assumes, is not by any means true. The oldest engineering of which we have any knowledge was intensely geographical in its effects—was, indeed, the only foundation of the earliest known civilizations. Ancient Egypt, with its 7,000,000 of people, 20,000 cities and overflowing granaries, was the creation of the engineer. Its first recorded king, some 4,000 years B. C., came down the Nile to the head of the Delta to build him a new capital. Not finding a site to suit him, he made one by changing the course of the river, an engineering feat which forms a very respectable introduction for the first historical man in the world. Under his successors, able engineers made Egypt what she was under the later Pharaohs. They dug reservoirs for retaining the water of the inundations, to be used after the subsidence of the river, and for its proper distribution the country was covered with a net-work of canals. Some of those reservoirs, such as Lake Mœris, 400 miles in circumference, were works, at the mention of which, modern engineers stand aghast. The cities and cemeteries were located on the edges of the desert, and a perfect system of irrigation produced that marvelous vegetable growth in the river valley between them which was the wonder of the ancients. But the works of the old engineers have mostly disappeared, and Egypt is what we now see her, much more strongly resembling the adjacent desert than the Egypt of Rameses.

The Mesopotamian plain furnishes a still more notable instance of geographical engineering. Ancient Chaldea, now a desert, was once a land of plenty. The skill of her engineers alone gave her people a local habitation and a name. Their works were planned on a scale, and executed with a boldness, which modern engineers are slow to believe. Canals 400 miles long, so large as to be called rivers, and whose remains attest that the name was not misapplied, and reservoirs which rivaled Lake Mœris in magnitude, watered and fertilized the ground, which produced an hundred fold. But the works of the old Chaldean engineers went to decay, and fruitful Babylonia became again a desert. That powerful empire, so long dominant in Western Asia, was the child of engineering; and when her people, either through stress of foreign invasion or domestic degeneration, or both, became unequal to the preservation of the great works which the old engineers had executed, she disappeared from among the nations.

The ancient Arabian Kingdom of Saba or Sheba, whose Queen visited

Solomon in the days of Hebrew glory, was the creation of engineering. A barren valley in the mountains which skirt the desert in Southwestern Arabia, through which flowed a torrent during the season of rains, was closed up by an immense dike or mole. This great structure was built of blocks of marble clamped together with metal, and cemented with bitumen. It was a hundred and twenty feet high, and the water which it intercepted formed a large lake in the valley above. The whole surrounding country was irrigated by water from this lake, and Saba became a name for all that was beautiful on earth. The most wonderful accounts of its riches and luxury were given by the later historians. Pliny calls Mareb, the capital, the mistress of cities and a diadem in the brow of the universe. An Arabian geographer says a good horseman could scarcely ride over the length and breadth of this cultivated country in a month; and the traveler might wander from one extremity to the other without feeling the heat of the sun; for the thick foliage of trees afforded a continual shade. The happy natives enjoyed among their groves and vineyards a peaceful security, clothed in embroidered garments of green silk, and rewarded with a double increase of their flocks and lands.

It is unnecessary to say that there are no such vine-clad fields and refreshing shade in Yemen now, nor does the earth contain a spot less likely to have produced them. After having stood 1,700 years, the great dike burst, and beautiful Saba became a desert. The great disaster is still an era in the traditions of the country. Although it occurred some 500 years before his time, Mohammed refers to it in the Koran as a judgment of Heaven. "Wherefore we sent against them the inundation of El Arem, and we changed their double gardens into gardens producing bitter fruit—this we gave because they were ungrateful." Mohammed was mistaken. The failure of the old engineering work had caused a great change in the geography of Saba—that was all. It is evident that geographical engineering, whatever may be the benefits which the world is destined to reap from it, is not exactly a modern institution. Our engineers may possibly surpass, but they ought not to rob the ancients.—*Globe-Democrat.*

THE AQUEDUCT OF SEGOVIA.

The great marvel of Segovia, the great achievement associated from time immemorial with the city, and blazoned in its municipal arms as its proud cognizance, is the aqueduct, or "Bridge," as it is called — a long double line of arches thrown across the ravines of the valley of the Eresma, and forming, as it were, a triumphal arch and gate of the city, as the traveler drives under it at the end of his journey from La Granja. It is called a Roman building, and attributed to Trajan, the Emperor whom the Spaniards claim as their countryman, but it bears no inscription, and apparently never bore any; nor does any record or hint occur in ancient writers, either of the edifice itself or of Segovia, that can furnish a clue to the date of the building, or the name of the builder. To doubt that the aque-

duct is a Roman work would be little less than heresy; yet there are some native critics who timidly, and, as it were, with bated breath, venture to suggest that its original design and construction, at least, may be anterior to the Roman domination of the interior of Spain, and that it may be claimed as the achievement of those Celtiberian or other indigenous races who, like the Etruscans, Ligurians, and other native Italian tribes, knew something about architecture before the Romans, and gave their masters some useful hints in that art in which they became so eminently proficient. This opinion is grounded on the fact that the Segovian Aqueduct is constructed of large blocks of stone laid one upon another, cyclopean fashion, without cement or mortar, in the style of which specimens remain in the walls of Tarragona, the huge stones in many instances underlying the layers of Imperial Roman masonry. Another argument urged in support of this theory is, that this aqueduct, although solid enough to have withstood the wear and tear of at least fifteen centuries, is by no means a "massive building," as the guide-books call it; it has nothing of the massiveness, loftiness, and grandeur of the arches of such aqueducts as strew with their ruins the Campagna of Rome, or the plain of Merida, but it is a light, airy, fairy structure, standing on very slender pillars, almost miraculously; and the wonder and beauty consist precisely in this, that the architect, whoever he was, contrived to give his work just the strength he needed to answer the purpose for which it was intended, grudging even one pound's weight of material which might give it an appearance of heaviness and clumsiness, and clash with the general look of the monument. So striking is this masterly adaptation, this perfect adequacy of the means to the end, so flimsy, fragile, and gossamer-like are the lines of this marvelous arcade, that popular tradition assigns it to a supernatural origin, the legend being that it was constructed in one night by the devil, enamoured of a Segovian damsel, whom he wished to save the trouble of carrying her pitcher up and down the stream to fetch water. The truth of the matter is that we are very much in the dark as to the development primitive art may have attained in ante-Roman times, among races flourishing under the blissful influence of these Southern climates. They have in Segovia a so called statue of Hercules in a convent bearing the appellation of *Casa de Hercules*, carved in all probability at a remoter epoch than any that can be assigned to the Aqueduct; and they have also two of these *Toros de Guisando*, of which Avila boasts four, of which there were sixty-three in the Peninsula in 1598, a number reduced to thirty-seven in 1820, and which have been a puzzle to the most learned antiquaries — carved masses of granite in the shape of quadrupeds, but worn so smooth and out of all shape by time, and by the inclemencies of the thousands of winters to which they have been exposed, that it has become actually impossible to ascribe them to any living species, extinct or living; and, though they are called "bulls," they are variously described as huge pigs, elephants, or hippopotamuses, or whatever else fancy names them. These specimens of rude sculpture — probably idols of a primitive race — are undoubtedly anterior to Roman times.

I could not hope to convey any distinct idea to the reader of the magnificence

of the Segovia Aqueduct, by the statement, borrowed from a very able monograph on the subject by Don Andrès Gomez de Somorrostro, to the effect that the water of the Fuenfria, running through the Rio Frio, was brought to it from the Guadarrama Mountains, over a distance of 10 or 11 miles, and that the aqueduct was made to go through several bends and turnings, to check the impetuosity of the stream, running 216 feet to the first angle, 462 feet to the second, and 937 feet to the third, where it becomes a bridge, spanning the valley from bank to bank, and resting at the end on the solid rock on which stands what is left of the battlemented walls of the town. The total length of the aqueduct is thus 1615 feet, and consists of 320 arches, which begin single and low, but rise gradually as the ground sinks, to maintain the level, and become double, one tier over another, as they vault over the gap of the valley, over the stream and the highway, all along the range that faces the traveler as he approaches to, and passes under it, entering the town. The three central arches are the loftiest, and rise at a height of 102 feet. These are on the nether tier surmounted by three layers of stone somewhat in the shape of a step, intended as a cornice to mark the locality of the towngate, and over the step in one of the pillars of the upper tier are scooped two niches, with a statue of the Virgin in the niche looking to the town, and in the other at the back a nondescript figure that priests call St. Sebastian, but in which the Segovians fancy they behold the effigy of the Satanic architect of the bridge. No words and no picture could convey the impression wrought upon the traveler by the sight of this magic building. The whole structure is of granite, light gray, as found in the quarry, but turned by age to a light pearl and purple tint, glowing like jasper in the deep blue of this semi-Alpine Castilian sky. The blocks of stone on a near inspection seem to have been laid upon one another clumsily and, as it were, at hap-hazard, some of them so daringly jutting out and hanging over as to suggest the apprehension that the whole fabric may at any time collapse and slip down to the ground like a castle of cards. Yet the bridge has been standing, perhaps, 2,000 years, and looks intact; and the design, seen at a proper distance, is a model of ease and elegance, relying, one would say, on mere symmetry and balance for solidity. The stones rudely cut in large, long, square blocks, bear the holes of the iron clamps by which they were hoisted up to their places; they were worn smooth and almost round by time and storms, but sound at the core; and at the base of the pillars, as well as at various stages up the shafts, and at the turning of the arches, there are cornices of what seem to have been black marble, but now everywhere chipped and cracked, and almost altogether fretted away.

The Aqueduct is the only thing really living in poor dead Segovia; the necessity of securing a constant supply of better water than what flows between the ravines of the Eresma compelled the construction of this work when the place was a mighty city, and insured its preservation as the town sank year by year to its present forlorn and dilapidated condition. The Moors, who sacked the town in 1071, pulled down thirty-five of the minor arches, but the watercourse con-

tinued uninterrupted, the people contriving by woodwork to prop up the wooden trough or pipe running at the top. The dismantled arches were restored as much as was practicable, in the original style, in 1483, by Queen Isabella the Catholic, and the Aqueduct has suffered no outrage from that time. What is more properly called the bridge — *i. e.*, the double range of arches across the valley — escaped even the ravages of the Arab invasion. There is something exalting and flattering to human pride in the contemplation of this edifice, which, like the Pantheon at Rome, is between fifteen and twenty centuries old, and yet not a ruin. One dreams of the works of men that have risen and fallen in the adjoining city, while the aqueduct has been standing and performing the humble, yet vital, service for which it was intended, unmoved by the joys or woes of the population to whose most pressing wants it ministered. The ancient cathedral begun, it is said, in the sixth century, finished in the twelfth, where councils were held and kings were crowned, used as a fortress against ruthless enemies, and so ravaged that its Holy of Holies had to be removed to the spot where the present edifice rose in 1525; the Alcazar, till 1866 a masterpiece of Royal magnificence, now a mere wreck, destined to moulder on the ground to the end of time; the scores of churches, convents, sanctuaries, chapels, and hermitages, crowding the streets of the town and its suburbs, some of the Lord's houses now closed for want of worshippers, some of the fat fraternities dwindling in numbers and thinning in flesh as, if not in faith, at least the lavish charity of their patrons cooled and fainted; the fortress-palaces where proud nobles learnt valor and courtesy, then sulked and idled, and laid aside the energies and spirits which made them the bulwark and the scourge of their meaner countrymen — all that made Segovia in the middle ages, and unmade it in modern times — had its rise and fall, its life and death, during the long period since the aqueduct first threw the shadow of its aerial arches on the skirts of the rocks on which the city stands. Mighty Castilian kings, with their host of iron-clad warriors; the sweet and pious and thrifty Isabella on her palfrey, with her crafty Aragonese husband and her Cardinal-Minister by her side; the popular heroes, the rebels, Padilla and Juan Bravo; the sallow and gloomy Philip II., and, perhaps, Columbus and Cortez, and a host of minor notabilities, rode centuries after centuries under these arches. The records of great events — the long war against the Moors, the formation of the Spanish Monarchy, the extinction of the people's liberties, the expulsion of the Jews, the revolt of the *Comineros*, the decline of the national character, the repeated French invasions, and the re-vindication of the country's soil from the hated foreigner — all seem engraved on those slowly, yet eternally, crumbling stones, piled up by the constructive genius of a man who will be forever nameless. Those swarms of swallows and martins which hover on the wing in clouds about the lovely fabric, the shrieks of which are almost the only sound enlivening the air in the stillness of the summer sunset, have been there—they or their progenitors—ever since those arches were fi st bowed. The clay of their nests, hardened by ages, has clung to those stones since they were laid; generation after generation of these erratic

birds have come back year by year from remote regions to their favorite haunts in those stones, and have found their homes undisturbed season after season.—Special correspondence of *The London Times*.

GEOGRAPHICAL NOTES.

EXPLORATION OF CENTRAL ASIA.

A few weeks ago it was announced that the projected grand expedition of exploration to Central Asia, presided over by the Grand Duke Nicholas Constantinovitch, had been abandoned. This is not the case; the scheme of exploration has been greatly enlarged. Professor Sorokin, Botanist Pelman, Artist Simakoff and the Engineers Liapunoff and Sokolovsky have arrived at Tashkent, and other scientific and military members are on their way thither from Orenburg. Captain Zouboff, the commander of the naval section of the exploration party, instead of proceeding to Tashkent, has gone direct from Kazalinsk to Khiva, where he is making arrangements for the survey of the Oxus. In order further to make this successful he has taken with him a steamer purchased on the Volga at Samara, at a cost of 40,000 roubles. As originally arranged, the expedition will survey the railway route from Kazalinsk to Balkh via Tashkent; it will explore the course of the Oxus from Balkh to Khiva, and then will examine the ancient bed of the Oxus as far as the Caspian. The only point in the programme undecided is whether the Grand Duke Nicholas shall command the expedition or not.

Capt. Wm. Kennedy, who commanded the expedition sent out by Lady Franklin, in search of her husband, writes as follows in reference to the selection of men for the American expedition to Lady Franklin's Bay, in 1880:

"The men I would call the right sort for Arctic work, would be medium sized, strong, wiry, resolute, good-natured, musical, orderly, self-reliant and self-controlling men—men, for instance, that could deny themselves even tobacco, that prolific source of suffering from thirst in a region where the temperature exacts such an amount of vapor from bodies that require a constant supply rather than its continual waste.

My men suffered more from this than from frost bites, whilst a non-smoker, like myself, never once suffered from this cause, or even from hunger, though daily on foot for over twelve hours at a stretch. I should also prefer men whose feet and hands did not perspire, to those that did, because being in circumstances where they cannot dry their socks or mitts, they are more liable to frost bites."

INTERNATIONAL COURTESY.

The Lords of the British Admiralty have given orders for the making of a handsome piece of furniture from the timbers of the old Arctic exploring ship Resolute for presentation to Mrs. Grinnell, the widow of the late Henry Grinnell, of New York, who fitted out at his own expense two expeditions for the search of Sir John Franklin.

AFRICAN EXPLORATION.

Orders have been sent by the African International Association to M Cambier, commanding the Belgian expedition, to push on 300 miles beyond Lake Tanganyika in a northwest direction, and establish a station at Niangwa, on the Lualaba or Congo. M. Popelin, who commands the second Belgian expedition, which left Zanzibar about the middle of July, will found a station, the first of the series, on the eastern bank of the Tanganyika. Mr. Stanley is trying energetically to ascend the Congo. If he succeeds, he will meet M. Cambier's column, and the continent will have been completely crossed. Pellegrino Matteucci has landed in Naples on his return from his expedition to Abyssinia. He is to go to Monza to hand to the King of Italy the friendly letters addressed to him by King John, as well as the presents this African monarch has sent, and among which are two little tame lions. In November next, Dr. Matteucci will leave again for Central Africa, at the head of an expedition organized under the auspices of the Milan Exploration Society. He will once more attempt to cross the country of the Gallas, will reach Kaffa, explore the country inhabited by the small tribes who had not been visited on previous expeditions, and return to Europe by way of the Blue Nile.

THE DUTCH ARCTIC EXPEDITION.

The Dutch Arctic exploring vessel, the Willem Barentz has returned to Hammerfest, Norway, after penetrating as far as Francis Joseph Land. This expedition left Amsterdam on May 5, 1878, and touched at Vardo on July 19th, in order to land dispatches. The voyage was universally known as a "trial trip" The Willem Brentz passed Jan Mayen, Spitzbergen, and Bear Island, falling in with the "ice-pack" in latitude 78 deg., and though the weather was not favorable, many important scientific observations were made; a memorial stone was erected on Amsterdam Island, and a brief visit having been made to the Barentz and Kara seas, all that was possible, in the limited time at disposal, was done to advance the cause of science. The crew had a fine view of the whole island of Jan Mayen, a sight which few of their predecessors had enjoyed, the high land being, as a rule, shrouded in mist. The expedition returned to Amsterdam in the autumn of 1878, and money was again raised in the spring of that year, certain private persons subscribing, and the government affording no aid, toward a

refitting of the Willem Barentz. She is a small sailing schooner of eighty tons. She is commanded by Lieut. J. J. De Bruyne, a Dutch naval officer, with Lieutenants Koolemans Beynen and H. M. Speelman as second and third in command, with three or four scientific men and a crew of eight sailors.

THE NOVA ZEMBLA STATION.

M. Tyaghin, an officer of the Russian Navy, who went in July of 1878 to Novaya Zemlya with his wife, a child and three servants, to winter at the life-station organized on the Island, has just returned to Archangelse. All are well, and the little family has been increased by a new-born child. The winter was not severe, the greatest cold having been only —29°.1 Celsius; and on August 1, when M. Tyaghin left Novaya Zemlya, the thermometer rose as high as 16 degrees. The five Samoyede families who were sent to the same station are well, but one old man of more than sixty years, and two others, died from scurvy, and M. Tyaghin explains their death by the circumstance that they never went out of their dwelling and did not follow his recommendations. The hunting was good throughout the winter.

THE BENNETT EXPEDITION.

The following dispatch from Lieutenant De Long, commanding the Arctic steamer Jeannette, has been received at the Navy Department:

ST. LAWRENCE BAY, Siberia, Aug. 27,
via SAN FRANCISCO, Sept. 29, 1879.

Hon. R. W. THOMPSON, Secretary of the Navy, Washington, D. C.:—

Arrived 25th; leave for Cape Lodge Kamen to-night. All well. Natives report Nordenskjold passed south three months ago, stopping here one day, having wintered in Kalintchin Bay. Mentioned one officer, a Russian, who spoke the native language, as named "Charpish," possibly Lieutenant Rordquish, of the Russian Navy, accompanying Nordenskjold, who said the ship was going home. Leave here to verify account along the coast. Hope to reach Wrangel's land this season."

Conflicting reports are made as to the condition of the ice north of Behring's Strait, but the weight of evidence favors the opinion that the season is a good one for exploration in that direction.

CAPTAIN MARKHAM'S ARCTIC EXPEDITION.

A telegram from Tromso, dated September 22, announces the arrival there of the little Norwegian cutter Ys Bjorn, with Sir Henry Gore Booth and Captain Markham, after a satisfactory cruise. They met the first ice on the 4th

of June, at a distance of forty miles from the part of Novaya Zemlya coast called Goose Land. The Matochkin Shar was then impassable, and they therefore cruised along the west coast of Novaya Zemlya until they were stopped by the ice off Cape Nassau on July 15. They succeeded in passing through the Matochkin Shar on July 31, and found the Kara Sea full of heavy ice. Returning, they met the Dutch exploring vessel Willem Barentz on August 18. They then again shaped a course northward, along the Novaya Zemlya coast, and this time succeeded in passing Cape Nassau and in reaching Cape Mauritius—the extreme northwestern point of that land—on September 6. Finally they pushed northward on a meridian midway between Novaya Zemlya and Spitzbergen, and on the 12th they met the ice in latitude 78 deg. north, and longitude 47 deg. east. They passed onward and penetrated through loose streams of ice to 78 deg. 24 min., about eighty miles from Francis Joseph Land. A good natural history collection has been made, and further experience has been acquired respecting the ice in that sea which leads to the best Poleward route along the western coast of Francis Joseph Land. Captain Markham was to leave Tromso on the way to England on the 24th ult.

The September number of the Proceedings of the Royal Geographical Society contains Notes of a trip from Zanzibar to Usunbara, in February and March, 1879, by Keith Johnston; Notes on the Geology of Usumbara by J. Thomson, and an article on the origin of the Flora of the European Alps, with the usual synopsis of Society proceedings, &c.

THE NORTH-EAST PASSAGE.

Dr. Kar writes as follows in reference to the Nordenskjold expedition :

" I have read with deep interest and much pleasure the news in *The Standard* of this day of the completion of a distinguished Arctic explorer's great work, the effecting of a northeast passage, so long the dream and desire of many great navigators.

No man living was better suited to accomplish this grand undertaking than the distinguished explorer, Nordenskjold, full as he was of experience and sound judgment, with a magnificent intellect, stored with all the scientific knowledge requisite for bringing home a great store of useful and most instructive information.

Your article most justly classes this famous professor with the greatest of Arctic navigators; and the matchless Parry—were he alive—would, with the noble generosity that specially belonged to him, have been the first to acknowledge the fact.

Contrary to the probable general opinion, I think it quite possible that Nordenskjold's success may pave the way to the utilizing of this route as a short cut to the North Pacific.

It obviously possesses many advantages over its great rival the North-West Passage, in futile efforts to accomplish which, England has squandered many hunded thousands of pounds on mighty expeditions, each costing five or six times as much as the compact and efficient one that has now done its work so well. The disadvantages of the passage northward of the American continent are, the numerous islands and lands that obstruct the route, forming narrow channels, all of which have been found blocked with close-packed ice, either at one end or the other, as, for instance, Prince of Wales' Strait, at the north end of which, an ice-block stopped M'Clure and Collinson's ships, and Victoria Strait, near the south end of which, Franklin's ships were crushed, and where I know from personal observation that the ice pressure is fearful. On the shores of Arctic America we have only one great river (the Mackenzie) which produces any important effect in breaking up and driving the sea ice far from land, whereas, from the coast of Siberia at least three very large rivers, the Obi, Yenisei, and Lena are doing a mighty work of destruction on the ice floe in spring and summer, cutting three great gaps, and opening up spaces of open water for the winds and waves to have free action on what remains unbroken.

The Siberian route is also much straighter and less incumbered by islands than that by America.

It also appears to me that, for some reason or other, no doubt a good one, Professor Nordenskjold deferred his departure from Gothenburg to too late a date, namely, 4th of July, for when he reached Waigat's Strait, he learned from vessels anchored there that the Kara Sea had been eight days free from ice, and therefore navigable. He waited here three days for his little consort, the Lena, so that he lost altogether eleven days of apparently open water, during which he might have been making his way east, and, if so, have accomplished his great work by passing through Behring's Strait in one season."

GEOLOGY.

THE ROSEDALE GAS AND COAL WELLS.

J. THORNE, M. D.

Over a year since the Kansas Rolling Mill Company began drilling for Gas at Rosedale (4 miles S.W. of Kansas City). The work having been abandoned by the Company was continued by private enterprise until four wells have been sunk with the results tabulated below.

The wells are all near the town of Rosedale, within the radius of a mile of each other; all are in the valley of Turkey creek. No 1 is at the mill, No. 2 is over ½ a mile nearer Kansas City, No. 3 is ¼ of a mile above the mill (s.w.), and No. 4, ¼ of a mile north of the mill.

	WELL NO. 1. ft.	WELL NO. 2 ft.	in.	WELL NO. 3. ft.	in.	WELL NO. 4. ft.	in.
Surface dirt (loam, gravel and clay)	23	14	.	18	.	13	.
Limestone	40	5	.	21	.	20	.
Soap-stone	180	2	.	.	.	.	.
Black shale	.	.	.	2	.	2	.
Limestone	8	10	.	15	.	5	.
Soap-stone	.	118	.	75	.	8	.
Limestone	.	3	6	2	.	10	.
Soap-stone	.	59	.	60	.	127	.
Limestone	.	5	.	5	.	5	.
Coal	3	.	.	.	.	.	.
Black shale (gas)	.	2	6	.	.	.	.
Soap and Limestone	.	15	.	.	.	15	.
Green shale	20	.	.	.	.	.	.
Soap stone	.	40	.	35	.	8	.
Black slate	6	.	.	.	.	.	.
Sand shale	.	1	6	.	.	.	.
Soap-stone	20	9	.	.	.	.	.
Black slate	8	.	.	.	.	.	.
Limestone	.	2	6	5	.	4	.
Soap-stone	.	19	.	10	.	7	.
Green shale	20	.	.	.	.	.	.
Limestone	1	2	4	.	.	10	.
Soap-stone	.	4	.	.	.	.	.
Black slate (gas 50 lbs.)	.	1	8	.	.	2	.
Coal	5	.	10	.	4	.	.
Soap-stone	11	.	.	2	.	.	.
Fire-clay	.	1	6	.	.	.	.
Limestone	.	4	5	.	.	3	.
Sand shale (large stream of salt water)	.	.	.	11	.	.	.
Black slate	.	.	.	9	.	8	.
Limestone	.	.	.	.	.	7	.
Soap-stone	.	.	.	6	.	.	.
Black shale (80 lbs. gas)	.	.	.	15	.	10	.
Soap-stone	.	.	.	10	.	5	.
Limestone	.	.	.	1	.	5	.
Soap-stone	.	.	.	82	.	.	.
Black slate	.	.	.	.	.	5	.
Limestone	.	.	.	.	.	10	.
Black shale	.	.	.	.	.	5	.
Limestone	.	.	.	18	.	2	.
Black slate	.	.	.	.	.	4	.
Soap-stone	.	.	.	4	.	6	.
Limestone	.	.	.	2	.	3	.
Slate (strongest gas)	.	.	.	4	.	2	.
Limestone	.	.	.	.	.	2	.
Grey shale	.	.	.	.	.	3	.
Black slate	.	.	.	.	.	2	6
Coal	.	.	.	.	.	2	.
Soap-stone	.	.	.	2	.	.	.
Sand shale	.	.	.	16	.	10	.
Total depth of each well	345	320	9	430	4	330	6

The surface at Nos. 1 and 3 is about 50 feet above the Kansas City Water Works; No. 2 is about 20 feet less, while No. 4 is about 10 feet higher than No. 2.

The first thing which will be noticed in the above table is the great diversity in the Earth's crust, and this diversity constitutes the chief interest of the record. Thus the first limestone in No. 1 is 40 feet while in No. 2 about ½ a mile N.E. it is only 5 feet; at No. 3 ¼ of a mile in the opposite direction it is 21 feet, and at No. 4, between Nos. 1 and 2, it is 20 feet. Under the limestone comes soapstone. In No. 1 it is 180 feet, in No. 2 only 2 feet, while none is found in either 3 or 4 for some time. To a geologist the table will be full of such anomalies.

It is the object of this paper to present the facts only, leaving their analysis to others. The gas features of the wells are important in the relation they will sustain to economic questions. In No. 1 we find gas which burns strong from a 1 inch pipe at 274 feet, while 50 feet lower we have a pressure which could not be measured by the instruments at hand. In No. 2 we find it at 216 feet, and 92 feet lower we find it of 50 pounds pressure; (this pressure became much greater after a few days). In No. 3 we have a volcano. The flame, from a 3 inch pipe, is thrown over 20 feet horizontally, while from a 5 inch pipe it roars in a mass of flame 20 feet or more in the air. No. 4 is much the same as No. 3. The escape of gas is continuous and seems to increase after two month's time. It will be noticed that the gas always comes from the slate or shale formations.

The readers of the REVIEW may be interested in knowing how specimens are obtained from so deep a hole. The old method was by small particles brought up by the sand pump, but Mr. Charles Swan, the man in charge of the drilling, invented, for this occasion, a method whereby large pieces could be brought to the surface. First, a 3 inch hole is put down with a sharp drill, then a blunt instrument 5 inches in diameter, called a reamer, is put to work, carrying before it (in the 3 inch hole) a long cylinder or bucket, the rock as detached falls into the bucket and when drawn up shows the exact strata. This invention is of great value in determining the character of the Earth's crust. The coal found in No. 1 is not verified by the other wells; thus, its upper vein of 3 feet is not found in Nos. 2, 3 and 4—in No. 2 it runs out in black shale. The 5 foot vein in No. 1 becomes 10 inches in No. 2, about ½ a mile away, and is only 4 inches in No. 3, less than ¼ of a mile in another direction—while it becomes 2 feet or over in well No. 4; showing that the vein is less than a mile wide and runs north and south.

Prof. W. F. Stewart, of Virginia City, Nev., in an interesting lecture upon the subject of "Mineral Deposits," said that geologists and mineralogists disagreed as to the method of nature in the deposition of minerals, and unless the true method could be determined, the country's mineral wealth could not be developed properly. Men had argued that if the volcanic theory were true, gold, being the heaviest metal, would be found purer and in greater quantity at the lowest depths beneath the surface; but this had not proved to be the case. The Comstock Lode was first worked as a gold mine, and one-half of its bullion was still heavily alloyed with gold; at a depth of 400 or 500 feet it changed from a gold into a silver mine.

PLIOCENE MAN.

BY DR. CHARLES C. ABBOTT.

Without doubt, the memoir by Professor Whitney is the most valuable and interesting contribution yet made to the subject of prehistoric archæology. Not only has the topic great interest in itself, but this phase of it has an additional interest, because a portion of the evidence he brings forward has been subjected to much adverse criticism, not only by men of some scientific attainments, but by the popular secular, and the biased religious papers of the day. The author, however, effectually disposes of all objections, as we think, and clearly demonstrates the correctness of the conclusions he drew, years ago. While being occasionally hinted at in various ways, these conclusions have never been published *in extenso* until the appearance of the present volume.

We shall give in briefest outline the character of the evidence which Prof. Whitney here produces; it does not stand alone, but supplements and, we believe, confirms the indications of Tertiary man, both of Europe and Eastern North America. In his introduction the author remarks that "gradually the evidence has accumulated from widely separated regions, until the idea of prehistoric man has become familiar to geologists." He then asks, "How far back can man and his works be traced?" The memoir supplies an answer to this question so far as it relates to California. Any one who has spent days and weeks in searching for fossils or stone implements in gravel deposits, can testify how discouraging such work is. Millions of pebbles are to be glanced at and overturned, and often there is nothing but millions more to look at, when the surface of a bluff has been removed. In California, where the hydraulic method of attacking the gravel deposits is almost wholly employed, there is still less chance of finding objects of interest than there was in the older method of tunneling. Whether of bone or stone, traces of man subjected to violent displacement by streams of water are pretty sure to be destroyed or again buried by the rapid overturning of the gravel beds.

Much of the material on which Prof. Whitney bases his paper has been collected by Mr. C. D. Voy, and is now in the museum of the University of California. This material has been gathered principally from Mariposa, Merced, Stanislaus, Tuolumne, and Calaveras counties. In Mariposa county, stone implements and mastodon remains have been found intimately associated, at a depth of twelve feet. Much of like nature has been found in the two counties next referred to, while Tuolumne county is particularly mentioned as a region more prolific in human remains and prehistorie works of art than any other in California. This evidence of early man has been very carefully sifted by Prof. Whitney, and it appears that the fact of the remains being really found in such positions as to indicate great antiquity is fully demonstrated.

Calaveras county is more fully treated of, as the evidence is of somewhat different character, and has given rise to much discussion. "We now come,"

says Professor Whitney, "to a county where occurrences of human remains do not seem to have been as frequent as they were in the adjacent Tuolumne, but where one specimen has been obtained which has excited more interest than all the others put together, and which is popularly believed to be the only instance of the kind which has been met with in California. A perusal of the following pages will, however, it is thought, satisfy the reader that the belief of the existence of man in that region previous to the cessation of volcanic activity there, is not by any means supported by one item of evidence alone." The history of this "one item," the now celebrated Calaveras skull, is then given in minute detail. Suffice it here to state that it was found at a depth of 132 feet, and exhibits many peculiarities which tally with the statements of the finder, and are conditions which could only exist in a cranium found as this specimen is said to have been. This alone, as is most ably demonstrated by Prof. Whitney, should satisfy any one disposed to question the truthfulness of the statements made by the gentleman who found the specimen. Were nothing else ever to be found, there is in this Calaveras skull, as we believe, all that is necessary to demonstrate the existence of Pliocene man in California; but Amador, El Dorado, Placer, Nevada, and Butte counties have all yielded corroborative evidence. As Professor Whitney remarks, "the passage from Pliocene through Post-pliocene, if such a division can hereafter be maintained in this region, has been a gradual one, and some of the Pliocene animals have certainly lived close up to the Recent period. That a portion of the human remains and implements described in the preceding pages are as old at least as Pliocene, it seems hardly possible to doubt."

"The discoveries in California, India, and elsewhere seem clearly to indicate that the human race must have existed, over a large portion of the world at least, for an immense period of time in the primitive condition, that is, at the lowest possible stage of humanity — civilization it cannot be called. So far as California is concerned, the evidence all points in this direction. The implements, tools, and works of art obtained are throughout in harmony with each other, all being the simplest and least artistic of which it is possible to conceive. Whether found in the strata under the basaltic lava, or above, at any point in the detritus; we always recognize the same type."

The conclusions of Prof. Whitney's volume are as follows:

"*Finally*, as the summing up of the discoveries and investigations made by the Geological Survey in California, we have :—

"1. The clear and unequivocal proof, beyond any possibility of doubt or cavil, of the contemporary existence of man with the mastodon, fossil elephant, and other extinct species, at a very remote epoch as compared with anything recorded in history.

"2. That man, thus proved to be contemporary with a group of animals now extinct, did not essentially differ from what he now is in the same region, and over the whole North American Continent.

"3. That there is a large body of evidence, the strength of which it is

impossible to deny, which seems to prove that man existed in California previous to the cessation of volcanic activity in the Sierra Nevada, to the epoch of the greatest extension of the glaciers in that region, and to the erosion of the present river canyons and valleys, at a time when the animal and vegetable creations differed entirely from what they now are, and when the topographical features of the State were extremely unlike those exhibited by the present surface.

"4. That man existing at even that very remote epoch, which goes back at least to the Pliocene, was still the same as we now find him to be in that region, and the same that he was in the intermediate period after the cessation of volcanic activity, and while erosion of the present river canyons was going on.

"5. That the discoveries in California, and those in other parts of the world, notably in Portugal and India, present a strong body of evidence going to prove the existence, during an immensely long period, of the human race in its primitive condition—that is to say, in the simplest and rudest condition in which man could exist and be man.

"6. That so far as we know, there is no evidence of the existence of any primordial stock from man may have been derived, so far back at least, as the Pliocene. Man, thus far, is nothing but man, whether found in Pliocene, Post-pliocene, or Recent formations."

That some of these conclusions, here so positively stated, may be modified by future discoveries, is highly probable. Especially as to the discovery of some "primordial stock," do we think this to be the case. That such stock once existed is necessarily true; that all trace of it has vanished is improbable; and not earlier than the dawn of the Pliocene is it necessarily needful that one should go to seek for such traces. The Pliocene epoch was not a matter of a few years, and what the formations of that age, in other continents, may contain that shall throw light on man's origin, have yet to be gathered. When the Pliocene strata of Africa and Asia have been carefully examined, and they are found to contain no traces of man more primitive than those of California and elsewhere, then it will be proper to expect that such traces will be found in the Miocene. That unquestionable traces of the missing link are now resting in some tertiary deposits, we have not the shadow of a doubt.—*Science News.*

THE WONDERS OF GEOGRAPHICAL EVOLUTION.

It is to the mountains that we must betake ourselves to learn the plan of the terrestrial architecture. On the great low-lands of the world the superstructure is concealed by a deep accumulation of superficial detritus, but among the mountains the whole construction of the earth's rocky coast is laid bare. There, amid all that is grand and most impressive in nature, the chronicles of the globe must be read. The lecturer referred to the poetry inspired by mountain scenery in all times, and the desire of men to explore the secrets of the hills. He then considered the apparent complexity of mountain structure, and showed wherein the

stratified rocks were a clue in unraveling the complexity. From a study of mountain architecture, he continued, we learn that the dry land has been upheaved at many successive periods, from the sea floor; that these upheavals have taken place generally along the same persistent lines, and that they were separated by prolonged periods of subsidence. After each uplift the new land has been exposed to disintegration, and its debris has been carried out to the sea bottom, there to accumulate into the thick masses of rock out of which future lands were to be formed. During the more important movements of upheavals, massive sheets of solid rock have been compressed, crumpled, and even rendered crystalline, and have been squeezed up along lines which have formed mountain chains. Volcanoes, too, have broken out along these lines of terrestrial disturbance, and have poured forth enormous volumes of lava from their heated interior. By revolutions of this nature, often repeated, the framework of the land has been slowly built up. During the early ages of tardy mountain growth, many tribes of plants and animals have come and gone. These reveal the fact that there has been a history and progress of organic life as well as the solid platform on which this life has been manifested. Generation after generation has passed away; species have changed, even whole types of existence have entirely disappeared, but the reports of this progress in the organic world have been preserved within the rocky frame-work of the land in sufficient fullness to serve as landmarks in geological history. The remains of the extinct ferns and trees, corals and shells, fish and reptiles, entombed within the mountains, becomes the clue by which the successive dates of the upheaval of these mountains are relatively fixed. They bring before us glimpses of the geography of the long vanished past—here a fair woodland with its lakes and streams; there a sandy shore bounded by bird and reptile; while often amid the rugged landscapes of the heart of a continent they tell us that there of old lay "the stillness of the central sea."—*Prof. Geike.*

MEDICINE AND HYGIENE.

DIGESTION AND DYSPEPSIA.

A remarkable discussion, which has been going on for some time at the medical societies in Paris, has terminated in an important lecture by M. Charles Richet, upon the subject of digestion and the hygiene of the digestive organs. He has, in this instance, brought forward some very useful considerations, which cannot fail to interest our readers, since perfect health and the proper treatment of disease depend so entirely upon our knowledge of the functions here discussed.

The first question is: What is the influence of the various alimentary substances upon the secretion of the gastric juice? This product of our organism

contains two different chemical principles, hydrochloric acid and pepsin, and it is necessary to consider the influence of food upon each of these substances, that is, on the secretion of the acid, and on the secretion of pepsin.

As regards the secretion of acid, there is a fact which predominates the whole physiology of the stomach. This fact may be condensed into a few words, and we have proclaimed it when we assert that the gastric juice always tends to preserve a certain state of acidity. In the case of man, this acidity is represented by 0.2 per cent. of hydrochloric acid, but varies, according to circumstances, from 0.1 to 0.3 per cent. of HCL. When alkaline substances are taken, there occurs an increased secretion of the acid; it becomes so abundant in this case that, in the course of a few hours, not only have the alkaline substances been entirely neutralized, but the gastric juice has recovered its normal degree of acidity.

On the other hand, if acids are taken, a most curious thing occurs. In this case the gastric secretion is dried up, or slackened for awhile, until, the acids being got rid of, the stomach recovers its normal or primitive acidity. This appears to occur by exosmosis of the ingested acid, whilst the acid secretion remains suspended. Now M. Charles Richet tells us that the consequence of this fact is that acid food, such as children and young girls (especially those who are subject to hysteria) are so fond of, is bad food for the stomach. They impede the gastric secretion, and the normal hydrochloric acid of the stomach is replaced, for the time, by acids much less favorable to digestion, such as tartaric, oxalic, citric, acetic acids, and others, whose action upon albuminous substances is very different from that of hydrochloric acid.

The same remarkable phenomenon occurs when salts of these organic organs form a large portion of the ingesta, such as tartrates, citrates, etc. These salts are all decomposed by the normal acid of the gastric juice, their acids are displaced by the hydrochloric acid, and so become free. Thus the stomach receives again free tartaric or free citric acid, etc., and we have a repetition of the circumstances alluded to above. Therefore, we must, according to Richet, look upon all acid liquids, such as vinegar, sour fruits, lemon juice, etc., as being unfavorable to gastric digestion, when inquired into from a hygiene point of view.

Another very interesting fact relates to fermentation of the food in the stomach. When alimentary substances are withdrawn in a half chymified state from this organ, and their degree of acidity determined, it is found that this acidity has increased, that it is evidently higher than the normal degree, that a certain amount of fermentation has taken place, both in normal health and in pathological cases. This fermentation, the author asserts, is due, at least partially, to those lower organisms termed "ferments," or "organized ferments," which are contained, more or less, in all kinds of food. It is often very useful to digestion, but sometimes not so, and then it gives rise to acid dyspepsia, with flatulency, which is characterized by acid eructations. Most frequently it is found to be lactic fermentation, but sometimes butyric fermentation occurs, which evolves hydrogen and carbonic acid.

Now, according to the same authority, there are two methods, in appearance contradictory, for causing such exaggerated fermentation to cease, and so to get rid of the dyspeptic symptoms. Both methods, though so opposite in nature, lead to the same result. If lime, or alkaline carbonates, or magnesia, is prescribed, these basic substances saturate the abnormal acid, and when no more excess of acid is present, the mucous membrane of the stomach will be enabled to secrete gastric juice with its normal acid as before. But if instead of administering alkaline or basic substances, mineral acids are prescribed, such as hydrochloric or sulphuric acid, the result will be the same. M. Richet has, at least, convinced himself by experiment that those fermentations caused by microscopic organized ferments are impeded by the presence of a mineral acid. There may be a considerable amount of truth in this from a theoretical point of view, but, practically, colic is produced by the slightest quantity of mineral acid in the stomach, pointing to the fact that nature never intended it to be there, except in the shape of gastric juice, the chemical properties of which are still in great measure hidden from us.

If M. Charles Richet has found that a minute dose of hydrochloric acid, or of sulphuric acid, will overcome what he calls acid dyspepsia, the result of fermentation, he will have caused medical science to have taken a decisive step in a very troublesome and much frequented thoroughfare.

Meanwhile, let us see what he has to tell us on the second question — the influence of the various alimentary substances upon the secretion of pepsin. Since the experiments of Beaumont, Claude Bernard, and Schiff have thrown so much light on this subject, it is well known that all excitations of the stomach do not produce a gastric juice equally favorable to the digestion of albuminous matter. Cellulose, unripe fruit, salad, and spinach, for instance, were found to be very indigestible. They cause an abundant watery flux, in which there is very little pepsin. On the contrary, when milk, meat, or eggs are taken, there is a great secretion of pepsin.

But there exists one important cause of pepsin secretion which might be overlooked by a superficial observer, but should always be present in the mind of the medical man, and this is *appetite*, which must be considered in connection with its opposite, or *disgust* for the particular kind of food offered. At the moment that food is presented to a dog there is an abundant flow of saliva; at the same instant the mucous membrane of the stomach reddens, and a secretion of pepsin occurs. Precisely the same thing occurs in man also, and those who are acquainted with the predominating influence of the nerves upon secretion in general, and have present in their minds the intimate dependence of the gastric membrane upon the central nervous system by the intermediary of the pneumogastric nerve and the medulla oblongata, will not be surprised at it. In the same manner vomiting, nausea, and disgust for food are accompanied by a contraction of the vessels of the face, and contraction of the muscles of the stomach. The mucous membrane of this organ then turns pale like the face of the individual, and in these conditions the secretion of gastric juices ceases.

No intelligent medical man would prescribe any particular kind of food for a patient unless he had carefully informed himself whether this patient possessed an antipathy for such food.

The last point which we shall examine in M. Charles Richet's lecture concerns the influence of the gastric juice upon the various kinds of food; in other words, the digestibility of the various alimentary substances in daily use. Milk is the most easily digested of all these. After ingestion of a pint of milk scarcely a trace is to be found in the course of an hour. It appears probable that milk contains some principle not yet isolated by chemists, the action of which is very similar to that of pepsin, and adds its influence to the latter in the phenomenon of digestion. At the same time M. Richet admits that milk supplies, during this function, a certain amount of lactic acid which co-operates with the acid of the gastric juice. The milk of the cow is, during the function of digestion, precipitated in coarse clots of caseine, whilst that of woman, and mares', and asses' milk are precipitated in much finer granulations, that are considerably easier to digest Hence the inapplicability of cow's milk to the nutrition of very young children; hence, also, the advantage of mares' milk, or asses' milk for cases of dyspepsia in subjects of delicate constitutions. For the young child, the mother's milk can be replaced by nothing; in this all our greatest authorities agree with Dr. Richet. On the other hand, experience has taught us that whatever disease a patient may be suffering from, even in cases of cancer, ulceration, and dyspepsia, a milk diet possesses the greatest advantages.

Without following our author further on the subject of food itself — better known, perhaps, in England than in France — we will conclude by referring to his hygienic precepts as regards digestion and dyspepsia. These are—to live upon a mixed diet, with little wine, and few aliments of an acid or woody (cellulosic) nature. To take moderate repasts. Mankind suffers more from over-feeding than from the contrary. It is a great mistake to imagine that the more food one takes the more mental or bodily work can be done. Over-feeding is the great curse of the age, and equals that of over-drinking by the numerous diseases to which it gives rise. To take our meals with regularity, always at the same hour, and to take care that whilst digestion is proceeding after a meal no food, to interfere with it or check it, is introduced into the stomach. In brief, one digestion should be allowed to terminate before another is begun.

With regard to the hygiene of dyspeptics, the medical man alone can advise according to the constitution and tastes of his patient; but a milk diet is, in most cases, fraught with the greatest advantages, and is no doubt in strict accordance with physiological laws.

DWELLING-HOUSES; THEIR SANITARY CONSTRUCTION AND ARRANGEMENTS.

BY PROF. W. H. CORFIELD, M.A., M.D. (Oxon).

Ventilation, Lighting, and Warming.

The air in our houses is rendered impure in various ways, but chiefly by our respiration, and by the products of combustion that are allowed to escape into it from lights and fires. The air that we expire contains a certain quantity of foul, or putrescent, organic matter. It is charged with moisture, and contains about five per cent. less oxygen, and nearly five per cent. more carbonic acid than the air that we inspire. It is neither the diminution of oxygen nor the increase of carbonic acid in the air of rooms that is of the greatest importance to living beings, but the accumulation of foul organic matter, and the excess of moisture. It is this which renders such atmospheres stuffy, and not the diminution of oxygen or the increase of carbonic acid, which are so slight as to be of little importance, even in overcrowded rooms. Nevertheless, since the increase in carbonic acid is proportional to the increase in other impurities, and since we can estimate very accurately the amount of carbonic acid in the air, the increase of carbonic acid is taken as an index of the impurity of the atmosphere. The average amount of carbonic acid in the outer air is four parts in ten thousand. Professor De Chamont found by his experiments that, whenever the amount of carbonic acid in the air of a room exceeded the amount in the outer air by more than two parts per 10,000, the air of the room was not fresh, that is, say, that the foul organic matter in it and the excess of moisture were sufficient to make the room stuffy. Hence, two parts of carbonic acid per 10,000 of air, over and above that in the outer air, are taken as the limit of respiratory impurity. As an adult breathes out, on the average, six cubic feet of carbonic acid in ten hours, it is clear that, in order that the air of the room in which he is may be kept fresh, he must have 30,000 cubic of air in the ten hours, or 3,000 per hour. In this climate we cannot change the air of a room more than three or four times per hour without causing draught, and so each person ought to have from 1,000 or 750 cubic feet of space, the air of which should be changed three or four times per hour respectively. The way in which this space is arranged is also a matter of some importance. For instance, the air above a certain height is of little use for purposes of ventilation if combined with too small a floor space. To take an extreme case — a man standing on a square foot of ground, with walls 3,000 feet high all round him, would be in 3,000 cubic feet of space; but it is quite obvious that he could not live in it. But, even without any inclosure at all, and without any limit as to height, it is not difficult to conceive a place overcrowded. For instance, all the inhabitants in the world, men, women, and children, could stand upon the Isle of Wight; but it is quite certain that they could not live there, even

if it were only for the want of air. So it is usual, in estimating cubic space, to disregard the height above eleven or twelve feet. It is also obviously of importance that the floor space should be properly distributed; but about this, so far as dwelling-houses are concerned, there is no need to enter into particulars. We are not able to insist on anything like 1,000 or 750 cubic feet of space in all instances, and amounts varying down to as low as 300 cublc feet per individual are adopted. In the case of a family living in one room, which is so small as to afford less than 300 cubic feet per individual, it is usual to consider that the limit of overcrowding which should be allowed by law has been reached. We cannot have, as a general rule, rooms so large that the air does not require changing while we are in them. Thus, for instance a person in a bedroom for seven hours consecutively requires about 21,000 cubic feet of air if the atmosphere is to be kept fresh. Supposing him to have this without change of air, he would require a room, say, 70 feet long by 30 wide and 10 high. This makes it quite clear that in rooms such as we have there must be a change of air.

In studying ventilation from a practical point of view, the chief agents that we have to consider are the winds and movements produced in the air by variations in its density, usually brought about by variations in its temperature; the property of the diffusion of gases by means of which the air is brought to a uniform composition when the temperature is the same throughout, being one which, practically speaking, does not affect the question much. With artificial methods of ventilation, in which the air is forced in a certain direction by machinery, we have little to do, as few of them are suitable for use in dwelling-houses. The wind, as an agent of ventilation, is powerful, but its disadvantage is that its action is irregular. When all windows and doors can be opened, a current of air which may be imperceptible is quite sufficient to change the air of a house in a very short time, and houses that have windows on both sides are for this reason more healthy than houses built back to back, which can never have thorough ventilation. This is the direct action of the wind, which may generally be utilized in large rooms with windows on opposite sides, like school-rooms, by opening that which is nearest to the direction from which the wind comes a little way at the top, and also opening the one which is diagonally opposite to it at the top a little further than the first one. The direct action of the wind has also been utilized for ventilating large houses by Silvester's plan, which consists in having a large cowl, that always faces the wind, at the top of a pipe leading down into cellars in the basement of the house, where the air can be warmed by stoves, and allowed to ascend into the house. By this plan the holds of ships are frequently ventilated. But the aspirating action of the wind is, perhaps, of greater importance. When the wind blows over the top of a chimney, or over a ventilating pipe, it causes a diminution of pressure of the column of air in the chimney or ventilator, and so produces an up-current upon precisely the same principle that little bottles made for distributing scent about apartments act. For this reason, it is, as was hinted in the last lecture, important that chimneys should be higher than the

surrounding buildings, so that any wind that blows may cause or increase an up-draught in them. In this way not only is smoke prevented from ascending into the rooms, but the amount of air carried through rooms up the chimneys is increased, and the ventilation of the house improved. There being, then, in ever house, and frequently in every room, a shaft—whether sufficient or not, we will consider by-and-by—for the escape of air, it becomes of the first importance for us to consider the means by which air may be admitted into our houses, and into our rooms. In summer, and whenever the air is as warm outside the house as inside of it, there is no difficulty about this. We have only to open the windows—wind doors, remembering the proverb that "Windows were made to open and doors to shut"—on both sides of the house, and the air is generally changed fast enough, but it is in winter, when the air is colder outside than inside, that the difficulties arise, and so in speaking of ventilation I shall always assume that the air outside the house is colder, and therefore heavier, and exercises greater pressure than the air inside it. This being the case, it follows that if we open a window, or make an aperture through a wall into the outer air, or through the wall of a room into a passage or staircase, in which the air is colder than it is in the room, air will come in. In fact, a room under these conditions may be looked upon as if it had water outside of it, and it is quite apparent that, in such a case, if you bored a hole through the wall in the water on the other side, water would come in, and the air of the room would escape by the chimney. This is precisely what happens with the cold air outside. If no special opening is provided through which the cold air can come into a room, it enters through such openings as there are; by the apertures between the sashes of the windows, by the—perhaps fortunately—badly-fitting doors, crevices in the floors, walls, and cupboards, through the walls themselves, as has been shown by Pettenkofer, and sometimes down the chimney. If, then, air will come in through an aperture placed in any position, it becomes necessary to consider where apertures should be placed and what precautions are necessary with regard to them. Theoretically, the admission of pure air should be at the lowest part of the room, and the extraction of the vitiated air, which is warm, at the upper part of the room; but practically the outer air cannot be admitted without certain precautions at the lower part of the room by mere apertures, as everybody knows who has been accustomed to sit in a room when a draught comes under the door. On the other hand, if an aperture is made into the outer air through a wall at a few feet from the door, the air enters in a cold straight current for some distance into the room. If the aperture be higher up, it comes in and falls, just as water would do, on to people's heads, somewhere about the middle of the room. So it is quite clear that certain precautions are necessary in the admission of air so as to prevent draughts. Since we have, or ought to have, windows in all rooms, it will be convenient to consider, first, the ways in which they may be utilized for the admission of air. We cannot simply open a sash window at the top or bottom in cold weather without feeling a draught, but there are several ways in which this diffi-

culty may be got over. The simplest is by placing a board of wood underneath the lower sash, as suggested by Dr. Hinkes Bird, whose original model I have here. This board is sometimes now made with a hinge in the middle, so that it can be got in and out more easily; or the board, instead of being placed under the lower sash, may be placed across, from side to side, in front of the lower part of the lower sash, so that the lower sash may be opened to a certain height without any air coming in below it. These boards may be covered with green baize, or some other suitable material, so as more perfectly to prevent the entrance of the air at the lower part of the window. In either case, the bars of the sashes at the middle of the window are no longer in contact, and air comes in at the middle of the window, between the two sashes, taking an upward direction, in the form of a fountain, and producing no draught. This shows us the direction in which cold air ought to be admitted into a room—after the fashion of a fountain, in which it can be readily obtained, owing to its greater pressure, and not after the fashion of a waterfall. This simple plan, which I recommend very strongly for adoption, has two disadvantages, one that nervous people always fancy there is a draught if they see anything like a window open, and the other a much more practical one, but one that is common to most forms of ventilation that are inexpensive—that a certain quantity of soot enters. These conditions are, to a certain extent, got over by the plan suggested by several inventors—of boring holes through, or cutting pieces out of the lower bar of the upper sash. Such holes are not seen, and the air comes through them in a vertical direction into the room.

They can also be fitted with little boxes containing cotton-wool, through which the air will be filtered and deprived of soot, etc. This, of course, very considerably diminishes the amount of air that enters, and the cutting also weakens the framework of the window. I may here mention Currall's window ventilator, which consists of a metal plate fastened along the lower bar of the lower sash, and parallel to it, with an opening below the sash for the admission of air, which is thus deflected into a vertical direction by the metal bar. Here will be also a convenient place to mention the automatic sash fastener patented by Messrs. Tonks and Sons, by means of which the window is securely fastened when opened to the extent of three or four inches, either at the top or bottom, so that the window can be left open without anyone outside being able to open it further. This can also, obviously, be combined with the window block placed underneath the lower sash, so that air can be admitted in the proper direction, and the window still be securely fastened. Louvred ventilators may also be used in a variety of ways in connection with windows. Where there are Venetian blinds, it is only necessary to open the top sash, pull the Venetian blinds down in front of the opening, and place the louvres so that they give the entering air an upward direction. Glass louvres fixed in a metal framework may also be used, a pane of window being taken out and one of these ventilators substituted for it. The louvres can be opened and shut by means of a string, and they are so fixed that it is impossible to break them by doing so. They are generally fixed instead of one

of the top panes of the upper sash. It is better to place them lower down in the upper sash, and this is true of all inlets of air. If they are too high up, the air, being admitted in an upward direction, impinges against the ceiling, rebounds into the room, and produces a draught. The metal framework of these ventilators requires oiling and attending to or it will get rusty. In some places fixed louvres of wood, or still better, of strong glass, may be fixed with advantage, or swinging windows with sashes hung on centers may be used, as, for example, in water-closets; and these, where it is advisable, may be prevented from being closed by means of a small wedge of wood screwed to the framework. The blind so often placed across the lower part of a window may also advantageously be used as a ventilator, or, where no blind is required, a glass one may be used, this being made to swing forward on its lower edge, so as to give the entering air an upward direction when the lower sash is opened, as in the model here shown, which was presented by Messrs. Howard to the Parkes Museum. Where very large quantities of air require to be admitted, one or more sashes of a window may be made to swing forward in this way, as is now done in the large hall of Willis's Rooms. Near to all windows, in the cold weather, the air of the room is colder than at other parts of the room. This may be obviated, when considered advisable, by the employment of double windows, the layer of air between the two windows preventing, to a very considerable extent, the cooling of the air inside the room. It is not advisable to have double panes of glass in the same sash, as the moisture between them will render them more or less opaque in certain states of the weather. With double windows, air may be admitted by opening the outer one at the bottom and the inner one at the top.

Where French casement windows are used, as they sometimes are unadvisedly in this climate, ventilation may be provided by having a louvred opening above the casements of the window, or by making a glass pane or panes capable of being swung forward on the lower edge. Lastly, Cooper's ventilator is largely used for windows, and also in the glass panes over street doors. It consists of a circular disc of glass, with five holes in it, placed in front of a pane of glass with five similar holes, and working on an ivory pivot at its center. It can be moved so that the holes in it are opposite to those in the window-pane, when air will, of course, come in; or so that they are opposite to the places between the holes in the panes, when the air will be prevented from entering. It is obvious that the air is not admitted in an upward direction, but the disadvantage of this is partly counterbalanced by the fact that it is admitted in five small streams, and not in one large one, so that there is less probability of a draught. The air may also be admitted through apertures made in the walls or doors. The simplest way to do this is to make a hole through the wall, and fasten a piece of board in front of it in a sloping manner, so as to give the air an upward direction. It is better to put "cheeks," as they are called, on the sides, for they serve not only to attach the sloping board to the wall, but to prevent the air from falling out sideways into the room. This ventilator may be hidden by hanging a picture in front of it,

and will cause no draught. I may state here that it is better, in a large room, to have two or more small ventilators, of any kind whatever, than one large one, and that no single inlet opening should be larger than a square foot. Openings of half that size are preferable. It is calculated that there should be 24 square inches of opening per head, so that a square foot would be sufficient for six persons. In such an opening as has been described, wooden or glass louvres may be placed.

The same end may be attained by making one of the upper panels of a door to open forward with hinges to a certain distance, or even, in some instances, by fixing it in this position. An obvious disadvantage, and one which always has to be considered in making openings through walls and doors, is that conversation which goes on in the room can be heard in the passage outside. Sherringham's valve is a modification of this plan, and can be fitted either into an outer wall or into one between the room and the passage or hall. It consists, as you see, of a metal box to fit into the hole in the wall, with a heavy metal flap, which can swing forward, and is exactly balanced by a weight at the end of a string passing over a pulley, the weight acting as a handle, by means of which the ventilator can be opened or shut, or kept at any desired position. What has been said before applies to these ventilators; they should not be placed too near the ceiling, and this is the mistake that is generally made in fixing them. Stevens's drawer ventilator may also be mentioned here. The name almost describes it. It resembles a drawer, which is pulled out of the wall for a certain distance, and allows air to come into the room vertically, in several streams, between metal plates placed inside the drawer. Jennings's "Inlet," which is in use in the barracks, consists of an opening through an outer wall into a chamber in which dust, etc , is deposited, and thence between louvres into the room. Here I may mention that it is sometimes advised to place perforated zinc or wire gauze outside the entrance to the ventilators, so as to prevent dust, etc., coming into the room. This is not advisable, as the apertures get clogged up, and the entrance of air is much impeded. It is better to have an iron grating, which will prevent birds entering, and to employ other methods for preventing the entrance of dust, soot. etc. Where this is considered necessary, the plan of passing air through cotton-wool, which must be frequently changed, may be adopted.

Currall's ventilator for admitting air through the door is sometimes useful. It resembles his window ventilator almost exactly; a long slit is cut through the door, a perforated metal plate placed outside, and a flat plate fixed parallel to the door inside and in front of the slit, thus giving the air as it comes into the room an upward direction. An admirable plan for the admission of air into rooms is by means of vertical tubes—an old system, but one which has been brought into prominence of late years by Mr. Tobin. A horizontal aperture is made in the wall into the outer air just above the floor, and then a vertical pipe carried against the wall the height of from four to five feet. The cold air is thus made to ascend like a fountain into the room. It does so in a compact column, which only perceptibly spreads after it has got some height above the mouth of

the tube. It then mixes with warm air at the top of the room, producing no draught at all. In spite of the vertical height through which air has to pass before it emerges into the room, a cons derable amount of soot and dust of various kinds is brought into the room. This may be obviated by placing a little cotton-wool in the interior of the tube. This, however, although a very efficient plan, has the serious disadvantage of impeding the current of air. A better plan is the one patented by the Sanitary Engineering and Ventilating Company; a tray containing water is placed in the horizontal aperture in the wall, the entering air being deflected on to the water by metal plates. The greater part of the dust is thus arrested by the water, which is changed as often as necessary. In warm weather ice may be placed in the trays. Another plan is to place in the vertical tube a long muslin bag with the pointed end upward, and kept in shape by wire rings. This provides a large filtering area, and offers very large resistance to the passage of air. This may be taken out and cleansed as often as necessary. Several contrivances have been devised for the admission of air close to the floor, just behind a perforated skirting board. Among these are Ellison's conical ventilator, shown in the last lecture, and Stevens's skirting board ventilator, in which metal caps are placed in front of the inlet openings, and so distribute the air that no draught is felt. I think, however, that it is only advisable to admit warmed air at a low level into rooms, but there is no reason why such openings should not be made high up in the rooms—behind cornices, for example. Pritchett's paving, made of agricultural pipes, may also be used for making walls and partitions, and is obviously applicable for ventilation purposes, whether used as inlet or outlet.

We now come to speak of exit shafts and valves. The first and most important of these is the chimney, about which I have already spoken. I need only add here that it is advisable to do without the use of cowls on chimneys wherever it is possible. If the chimney can be made high enough it will not require a cowl, and if it cannot, a simple conical cap is generally sufficient to prevent down draughts. There is no doubt, however, that Boyle's fixed chimney cowl for preventing down draught not only does so, but produces an up draught in the chimney when the wind blows down upon it, as I can readily show you with the model I have here. A small piece of wool is made to ascend in a glass tube by blowing vertically down upon the fixed cowl placed upon the top of it. Of revolving cowls for chimneys, the common lobster-backed cowl is probably the best. Whilst speaking of cowls, I may as well mention that a variety of cowls, some of which I have here, have been invented with the object of increasing the up draught in exit shafts of various kinds; some are fixed, as Boyle's, Buchan's and Lloyd's, and some revolving, as Scott, Adie, & Co.'s, Howarth's, Stidder's, Banner's, Stevens's, and the one invented by Mr. Boyle, but discarded by him some years ago. Whether any of these increase the up current in exit shafts is a matter which is still under investigation, but I can show you, quite easily, that the common rough experiment, by means of which they are supposed to do so,

is entirely fallacious. Cotton wool is drawn up a tube at least as easily by blowing across it in a slanting direction as by blowing through a cowl placed on the top of it The fixed cowls have the advantage that they cannot get out of order. The revolving cowls have the disadvantage which is common to all apparatus with moving parts, that they are certain to get out of order some day or other. Whether they increase up draughts or not, there is no doubt that most of them prevent down draughts, and, like any other cover, prevent the entrance of rain. Openings are sometimes made high up in the chimney flue and protected by valves, the best known of which is Arnott's valve, which consists of a light metal flap, swinging inside a metal framework in such a way that it can open toward the chimney flue, but not toward the room. Any pressure of air from the room toward the flue will, therefore, open it and allow the air to escape from the room into the flue. Pressure of air the other way will shut it. The disadvantages of this ventilator are that it makes an irregular noise, although this has been, to a considerable extent, obviated by the india-rubber padding with which it is now fitted. It also occasionally admits a little soot, and, of course, air at the same time, from the flue into the room. Boyle's chimney ventilator, made by Messrs. Comyn, Ching & Co., is a modification of this. Instead of the light metal flaps there are a number of small tail flaps. These make little or no noise, but they are liable to be opened by a current of air in the chimney. It is obviously, it seems to me, at variance with sound sanitary principles to make openings from the interior of the room into the chimney flues, and then to trust to valves to prevent the air of the flue from coming in. A far better plan is to have shafts placed by the side of the flues, and this, of course, is better done when the houses are built. The easiest and most satisfactory way of doing it is by means of air flues and smoke flues combined, in which the air flues are moulded in the same piece of fireclay as the smoke flue itself. These air flues can be connected with the upper parts of the rooms, and up draughts will be inevitably caused, as the air in them will be considerably heated on account of its immediate contact with the outer side of the flue. Such shafts can only serve as inlets when the flues are cold, and so it is advisable to use them especially with flues that are always hot—as, for instance, that of the kitchen chimney—and it is desirable, wherever it can be done, to connect the kitchen with a different air-shaft from the other rooms, or it is possible the air from the kitchen may get into some of the other rooms of the house. Of exit ventilators not connected with the chimney flues; I may mention Mackinnell's, which also provides an inlet for air as well, and which is very useful in small rooms, closets, etc., having no rooms over them. It consists of two tubes, one inside the other, passing through the ceiling into the outer air. The inner one is larger than the outer one, and projects above it outside and below it an inch or so into the room. At its lower end a circular rim is attached horizontally parallel to the ceiling. The outer air enters between these two tubes, and is deflected by the rim just mentioned along the ceiling, so that it does not fall straight into the room. The vitiated hot air passes

out by the inner tube, the action of which is, of course, considerably increased if a gas burner or other light be placed beneath it. It is upon this principle that the lamps for lighting railway carriages are made, the reflector answering the purpose of the rim round the end of the inner tube, and the air to supply the lamp coming in between the reflector and the glass shade, while the products of combustion escape through the pipe leading from the middle of the reflector, and immediately over the flame Of course Mackinnell's ventilator requires a cover to keep out the rain, and it is necessary, in fact, to have a double cover, so that the heated air which escapes by the inner tube shall not be carried back into the room by the entering air. Tossel's ventilator is a variety of this, with a cover by means of which the action of the wind is able to be taken advantage of. The same inventor has also contrived one which can be used between the ceiling of one room and the floor of the room above, provided that this space can be well ventilated.

This brings us naturally to say a little about lighting. Candles, lamps and gas make the air impure. It is calculated that two sperm candles, or one good oil lamp, render the air about as impure as one man does, whereas one gas burner will consume as much oxygen and give out as much carbonic acid as five or six men, or even more. This is why it is commonly considered that gas is more injurious than lamps or candles, and so it is when the quantities of light are not compared, but with the same quantity of light, gas renders the air of a room less impure than either lamps or candles. If, in the dining room, instead of using five or six gas burners, as we too often do without any provision for the escape of the products of combustion, we used 40 or 50 sperm candles instead of 6 or 8, we should have a fairer comparison between gas and candles. I have no time to enter into a discussion of the relative merits of various kinds of candles and lamps, but with regard to gas I would say that, considering the fact I have just stated, it is always advisable to provide a means of escape for the products of combustion immediately over the gas burners. By this not only may these products be carried away, but with a little contrivance, heated air may be drawn out of the room at the same time, and so an efficient shaft provided, in addition to the one found already in the chimney. Very simple contrivances will answer this purpose. A pipe, with a funnel-shaped end, starting from over the gas burner, and carried straight out into the open air, with a proper inlet opening, is all that is required in some instances, as in badly placed closets. For large rooms, the sunlight ventilators are found to answer admirably. They should be provided with a glass shade, placed below them to intercept the glare, and to cut off a large portion of the heat. An elegant contrivance for dwelling rooms is Benham's ventilating globe light. In this, the products of combustion of the gas pass along a pipe placed between the ceiling and the floor of the room above, into one of the flues. This pipe, being surrounded by another opening into the ceiling of the room at one end, and into the flue at the other, is guarded at its entrance to the flue by a valve which can be easily shut when the gas is not

burning. This double tube, as it passes under the floor of the room above, is covered with fire-proof material, so that the floor is not affected by it. The joists, where they are notched, have iron bearers put across to support the floor-boards above. Air is admitted by another pipe passing through the wall of the house into the external air, and ending also in the ceiling of the room by openings around those of the exit shaft. Thus warm air is introduced into the room at the same time that vitiated air from the upper part of the room, and also the products of combustion of the gas, are carried out of it into the chimney flue.

I may say a few words about some grates and stoves that have been devised with the view of combining ventilation and heating. The first of these is Captain Douglas Galton's grate, in which there is an air chamber placed around the flue, and communicating on one side with the external air, and on the other with the atmosphere of the room by various apertures. The outer air which passes into this chamber is warmed by contact with the heated flue, and issues into the room, thus supplying the room with warmed air, and utilizing a considerable quantity of the heat that would otherwise be lost. There are several other grates, such as the Manchester school grate, made upon this principle, with variations in the arrangement of the inlet apertures, which are placed vertically like Tobin's tubes, etc. It is important in all these contrivances, where outer air passes through a chamber in which the back of the grate and flue is placed, that the back of the grate and the commencement of the flue in that chamber should be cast in one piece of metal, so as to have no joint. If there are joints they will become after a time defective, and the air from the flue is liable to escape into the chamber around it and be brought back into the room by the entering air. Some slow combustion stoves, as George's "calorigen," have air pipes passing through them, and have the external air warmed on its way through the stove into the room. Iron slow combustion stoves dry the air too much, and unless they are lined with fire-clay, are apt to become too hot and to cause an unpleasant smell in the room by the charring of the organic matter in the air. They are much more suitable for warming large buildings, where economy of fuel is an important object, than they are for use in sitting rooms or offices. It is usual to place a vessel of water on the top of these, with the view of obviating, as far as possible, the dryness of the air that they produce. It must be borne in mind that closed slow combustion stoves do not act as ventilators, as the air to supply the fuel—usually coke—is brought by a pipe from outside, and this is another reason why they are not so advantageous as an open fire or a quick combustion stove in dwelling-rooms. In the Thermhydric grate of Mr. Saxon Snell a small boiler is placed behind the grate, and communicates with a series of iron pipes alongside of it. These are filled with water, which is, of course, kept warm, and air is admitted to the room between these hot-water pipes. Thus, it is neither dried nor heated too much. The products of combustion are carried away by a flue, which may be placed under the floor; so that the grate, if required, may stand in the middle or in any other part of the room. Gas stoves are gradually

becoming largely used instead of coal, and, when proper provision is made for the escape of the products of combustion, they are certainly very convenient and cleanly contrivances. I have no doubt that this will, in the end, be found to be the proper use for gas, and that we shall cease entirely, or almost entirely, to use coal in our houses. By using coal in the way that we do, we lose all the valuable by-products—the ammonia, the tar, the carbolic acid, aniline dyes, etc., which are derived from the refuse of gas works, and which are worse than useless to us in our fires. Gas may be burned either mixed with air or not. In the first instance, a gas stove or grate filled with pumice stone or asbestus does not much resemble an ordinary fire, but if the gas be burned unmixed with air it is almost impossible to tell the difference. Generally speaking, it is found necessary when there are several gas stoves in a house, to have a special supply of gas with larger pipes for them. What the gas companies should do is to lend gas stoves of various kinds, especially cooking stoves, to their customers for a small annual payment, as is done very successfully in continental cities. It is important that gas cooking stoves should not give an unpleasant smell of unburnt gas as some do. This is not only a waste but a nuisance, as coal gas always contains carbonic oxide (an extremely poisonous substance), and should, therefore, not be allowed to escape into the air, even in the smallest quantity.

I have now to mention an artificial system of ventilation which has been lately introduced by Messrs. Verity Brothers. It consists of a fly-wheel fitted with fans or veins. The wheel is made to revolve by a jet of water directed against it, and supplied from a cistern overhead, the water passing off by a pipe into a cistern below. The apparatus can be fixed either in an inlet opening, and so made to propel air into the apartment through an aperture in the wall placed higher than people's heads, and made in a slanting direction, so that the entering air is shot upward toward the center of the room; or it can be used as an extractor, by placing it in an exit shaft, and causing it to draw the vitiated air out. The supply of water can be regulated by taps to the greatest nicety, so that the wheel can be made to revolve at whatever speed is desirable. The entrance pipes are sometimes fitted with a vertical tube containing a box, in which ice can be placed, or a holder for perfume or any deodorant. For smoking rooms it is found advisable to use the apparatus as an extractor only, and to allow the air to come in by means of Tobin's tubes. Dwelling-houses are seldom warmed and ventilated by means of hot-water apparatus, and so I do not think it necessary to enter into a description of the plans by which this may be effected. I need only mention Mr. Pritchett's "miniature hot-water apparatus," if I may so call it, by means of which a single room may be warmed and ventilated. The water starts from a small boiler, the size of an ordinary kettle, which may be placed on a fire anywhere, or heated by a spirit lamp, and passes through a narrow space between double cylinders, the inner cylinders being used for the admission of fresh air, which is warmed in passing through them, or for the extraction of foul air. The water is made to pass through the extraction cylinders first, while

it is hottest, and then through the others and back to the boiler. The cylinders are placed vertically, so that the air is admitted into the room in the proper direction. Other systems of artificial ventilation are suited for large public buildings, but are not adapted for use in dwelling-houses.—*Iron.*

PROCEEDINGS OF SOCIETIES.

THE SARATOGA MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

(*Continued.*)

INDIAN VIEWS ABOUT THUNDER.

Dr. J. G. Henderson, in the sub-section of anthropology, gave some interesting details of Indian notions concerning thunder and lightning. In the Illinois language the word for thunder *Wa-kiu-yan*, the meaning of which embodies the belief that thunder is caused by the noise made by the wings of a huge spirit-bird. It was thus that these Indians satisfied their curiosity in regard to the philosophy of the phenomena. "An orthodox Dakota Indian," said Judge Henderson, "had the same reasons for believing in the thunder-bird that we have for believing that the whale swallowed Jonah." The author analyzed the aboriginal ideas and superstitions relative to thunder and lightning, the central notions of all being that these manifestations are the direct acts of spirits. Almost all the tribes in the United States believed the thunder to be produced by the wings of a great bird, and that the lightning was the serpents that were invariably connected with the thunder-bird. Among the ancient tribes of the Mississippi Valley, the thunder, therefore, soon became a thunder god, who could be propitiated by sacrifices. The Illinois Indians offered up a small dog when a child happened to be sick upon a day when there was much thunder, supposing the latter to be a cause of the malady. Many accidents, like conflagrations, were attributed to this angry god, and some tribes did bloody penances in propitiation, often burning to death their own children. Statements that the Indians adored the thunder, however, the speaker believed to be erroneous. It was the cause of the thunder that they worshiped, and before which they burned tobacco and buffalo meat, or cut off the joints of their fingers, or threw their children into the fire, when they were overcome with fear. The Peruvians had as an idol a stone that had been split by the lightning. They offered it gold and silver. The natives of Honduras burned cotton-seed when it thundered. Other Southern tribes made no sacrifices on the approach of a storm, but abased themselves in the most abject fear.

The grandest conception of all, the author thought, was that of the Iroquois, who said it was their great god Heno, who rode upon the clouds, split the forest tree with thunder bolts, or hurled stones at his enemies. His home was under the roaring Falls of Niagara. He was a patron of husbandry, and in the Spring he was invoked to water and nourish the growth of their productions, while at the harvest festival they gave him thanks for rain. He was also the avenger of evil deeds, and the Iroquois trembled when his deep shout was heard rolling along the firmament. In Brazil, the thunder and thunder god occupied nearly the same place, and the author dilated upon the connection between this idea and the notions of fire-stones (flint, chert, etc.,) which runs through the whole Indian mythology. Some tribes give this god a sling with which to hurl the stones. In this way he explained the process of thought by which the thunder-spirits came to be the war-gods of the Dakotas and other tribes from whom were received the tomahawk, spear-heads, and other weapons of flint, and those supernatural paints which should protect them from the murderous shafts of their enemies. The wild rice being aquatic and looking like an arrow or spear, is also attributed to the thunder-spirit as to its origin. In Mexico great temples were built upon the sacred spots where lightning had struck. A curious notion among Peruvians was that the preserved bodies of twin children who died in infancy should be worshiped, supposing the father of one of them was the son of the thunder, the origin of the idea being the fact that the thunder-god of that people was one of the celestial twins Apocatequil and Piquerad. This tradition was utilized by Pizarro's missionaries to teach the Indians the doctrine of the Trinity.

In the thunder some of our Western tribes recognized the admonition of the Great Spirit of the Four Winds, that the time of corn planting was at hand. But the main and ruling idea everywhere was that the cause of the thunder was a bird under various disguises. They described its form and abode and food variously. The different shapes and habits were compared and analogies pointed out. Many professed to have seen it, or its feathers, or tracks, and some professed to have found its nest on pinnacles of the rockiest mountains. Usually it was described as compounded of parts of a man and parts of a bird, and it was the young birds which were charged with the mischief when the lightning did any harm. Judge Henderson thought if there was to be found any resemblance to an earthly bird the night-hawk was the species that had originated the idea.

Notwithstanding the thunder was so feared as a god, there were warriors brave enough to defy him, and the Sioux have an association whose exclusive privilege it is to fight the thunder. Instead of propitiating, they resisted in mock-battle the advance of the storm-cloud. The Southern Indians behaved similarly according to old writers. This introduced a very interesting account of "rain-doctors," and the other charlatans who engaged to produce fine weather. Passing over many interesting details, the theories of the manner in which the noise of the thunder occurred next claimed attention, and were discussed minutely in respect to curious details. The paper closed with a recapitulation and general

observations upon the Indian method of reasoning correctly but from false premises.

NATURAL HISTORY.

Dr. C. S. Minott read a paper on the anatomy of the tap -worms, one of a series of investigations upon the lowest worms. The tape-worms are closely related to the planarians and flukes, and the closest homologies can be demonstrated in all their organs. The structure of *caryophyllæus* was specially studied and compared with the other forms; the general conclusion being that the plathelminths cannot be classed together with the nemertean worms, and that their structure is much more complex than usually supposed, and that therefore, they cannot be considered as representing the ancestral type of the higher animals, but at the most a peculiar side branch, arising near the starting point of the evolutionary series.

In his paper on "bud-blight" insects, Dr. W. S. Barnard, of Cornell University, said that his attention had been called to the subject last June by the pear trees in the neighborhood of Ithaca. The ends of the twigs were enlarged and the buds fell off. In Saratoga he had seen the same ruin worked. In all pear-blights there appears a fungus arising from some injury, as excessive freezing, or beetle-boring. If the leaves alone blight with brown or black blotches, the cause is the presence of mites burrowing in the pulp. The death of buds alone cannot be ascribed to any of these adverse influences. The absence of fresh surfaces in the present case showed that the evil was not the work of cut-worms or caterpillars. He found it due to a very inconspicuous insect, well known in Europe as an old offender, under the name of the pear-psylla, (*Psylla pyri*). As this insect had never been described or figured in this country, Dr. Barnard supplied the deficiency and showed drawings. He also described the various methods of discovering their presence. The writer thought "bud-louse" an appropriate name since it is closely allied to the common plant-lice (*Aphidæ*). It is diminu'ive and and has a gradual and complete metamorphosis. It is provided with wings for flight, and has legs so strong that it can leap like a flea. It lays its pollen-like, almost invisible eggs on the petioles or along the veins of the leaves, (where the adults also, are commonly seen,) each anchored to its place by a filament. During the early life of the louse there exudes from the body a waxy secretion which forms a fibrous mesh on the plant probably to protect the young against the beating winter storms. To manufacture this secretion, and the "honey-dew" which they sqirt upon the leaf, as well as to nourish themselves, an immense quantity of the sap of the tree is consumed. The ants attend and milk these lice affectionately, as they do the aphides. Honey-dew is yielded by both young and old. In Europe this louse, in all its stages, attacks the leaves, blossoms and young shoots, gradually killing the tree. The main injury here is done by the larvæ, which destroy the buds by sucking the sap about their bases. Dr. Barnard thought the damage which this insect was doing to the pear orchards was very large, and liable to be spread widely. It appears to have been imported

into the United States 46 years ago, has done great harm, and is being widely disseminated through nursery sales. It therefore deserves close attention, and Dr. Barnard would be glad of additional observations to aid him in devising some means of successful warfare against it.

In discussing the cat's brain, Prof. Wilder pointed out the progress lately made in the study of the homologies of the features of this animal's brain, with the brain of other animals, and illustrated the matter by black-board drawings. The papers were technical, but the bearings very important. He thought his success in the study of brains was due to the fact that he was able to have perfectly fresh subjects for examination, and suggested that much is yet to be learned about the human brain when better and fresher specimens can be procured.

AN ATLANTIC ATOLL.

"The Geology of Bermuda" was the subject of the most popular paper before the Geological section on Tuesday morning. The author was Dr. William North Rice. The general form of the archipelago suggests the idea that it is a compound atoll, and if this is true, it is a matter of special interest, since it is the only atoll in the Atlantic Ocean. Many authors object to this view, but Dr. Rice thought the objections could be explained away. The rocks in Bermuda are, of course, all limestone, varying in texture. There are three kinds of coral rock—reef-rock, beach-rock and drift-rock. The first is generally easily recognizable, but the beach and the drtft-rock are often distinguished from each other with great difficulty. The geology of the island shows evidence of movements both of of elevation and subsidence. The caves, with floors of stalagmite below the water-level, the relation of beach and drift-rock on the south shore, and the organic remains in some of the rocks prove a former subsidence. It was during a period of subsidence that the atoll was formed in the usual way, at which time, also, the beach-rock was deposited. Then came a period of elevation, laying bare the lagoon and affording an opportunity for the enormous deposit of drifted sand which forms a marked peculiarity of the islands. Third—there was another subsidence, exposing the drift-rock to the erosive action of the ocean and thus producing the cliff shore. It was thought that these successsive changes were complementary respectively to the glacial elevation, the champlain subsidence, and the recent re-elevation of the continent. These oscillations were discussed at length. There are very few fossils in the island, but the general features of the rock formations are full of interest. The paper was made more interesting by the help of an admirable map.

THE HEIGHT OF THE GLACIER.

Prof. J. G. Smock, Asistant State Geologist of New Jersey, read a paper of general interest upon the limits and thickness of the continental glaciation in that State. It referred to the existence of a "great terminal moraine," which has

been described in several of the State geological maps, It runs from near Amboy to Plainfield, thence to Morristown, and thence almost due north, almost exactly along the line of the Delaware, Lackawanna and Western Railroad, to and beyond the Water Gap. This line of elevations rises on the eastern coast to a height of 100 or 5000 feet, but westward the hills rise much higher. From the varying height of these morainal hills Prof. Smock derived an estimate of the front of the great ice sheet. The height of the hill he considered the minimum thickness of the margin of the glacier at that point. But there are better evidences. On certain trap-rock mountains are boulder limits showing the top of ice glacier. These limits vary in different parts of the State, and many figures were given to show this. As a whole, Prof. Smock thought he had evidence to show that the thinnest ice was at the southernmost points, and that it grew thicker as the line of the margin receded northward. Not in New Jersey, but north of there, in the Catskills, it was possible to find many points that evidently had overtopped the glacier. By these investigations he concluded the average thickness of the ice in the Catskill was 3,000 feet. Reasoning from this fact he concluded that the increase of the thickness of the glacier made it cover the Adirondacks and White Mountains completely, leaving the Catskills as the only landmark.

EXPLOSIVE COMPOUNDS.

Prof. Benjamin S. Hendrick, of the United States Patent Office, read a brief paper on explosive and detonating compounds. He mentioned that from seven to nine times as much air should be mixed with street gas to make the most violent explosion. Hence accidents of the gravest sort happened from a very small leak of gas. The explosive compounds which are most in favor for practical purposes at the present day are made with a very small proportion of nitro-glycerine—say from 3 to 20 per cent. The solids that are mixed with the nitro-glycerine serve as a cushion, which prevents too ready vibration, and hence these new compounds are capable of being handled, transported, and used for many purposes which would have been impossible with the liquid.

The Thon-Industri Zeitung describes a sanitary paint for walls, ceilings and the like—one which renders the penetration of fluids or vapors impossible, and prevents the formation of fungi, at the same time being of such stability that it can be washed down with boiling water without injury. This paint is, essentially, a solution of stearate of soda in spirit, in the proportion of about fifty grammes of the stearate to 1,000 of sp. gr. 66. Spirituous solution of soap, of of all kinds and strength, can be applied in a similar manner, but the stearate of soda is far preferable. The paint is said to present an especially handsome appearance, and in the sick wards of hospitals, or in cattle sheds where disease is prevalent, can readily be mixed with disinfecting materials.

CORRESPONDENCE.

SCIENCE LETTER FROM PARIS.

NEW VIEWS ON DIGESTION — METEOROLOGY OF 1879 — METALLOTHERAPY IN HEADACHE — THE MEDICAL INTERNATIONAL CONGRESS AT VIENNA, ETC.

PARIS, September 27, 1879.

According to Hippocrates, certain aliments are not equally good; following Dr. Leven, certain others are bad for everybody. The latter is head physician of the Rothschild hospital in this city, and is well known for his skill and able writings. He is an experimental practician. Not content with studying his patients, he controls his experience by experiments on animals, a method that cannot be questioned provided the conclusions be correctly drawn. With Dr. Leven, the stomach is the center of health and happiness. We destroy it, he maintains, by eating and drinking aliments that are as dangerous as the poisons of Borgia or the philters of Macbeth. Discard soup; it overcharges the stomach with water, and thus weakens its power to digest essential food. Avoid fatty matters; these induce congestion of the stomach and stop its action. Salmon is a bad fish, because containing too much oil, and that Scotch servants know well, as, before engaging, they stipulate they shall not have to eat that fish more than twice a week. Ragouts are detestable; their spices irritate the digestive tube. Sauces are to be excommunicated, and *pate de foi gras*, truffled, means suicide. Suppress cheese—it is fatty; fruits, for they are acid; ices, as they arrest digestion, and wines and liquors, as they act like so many hot irons. As a compensation, patronize broth, milk, boiled eggs, roast or grilled meat, boiled beef, leguminous vegetables, a little tea and coffee; drinking only water, and as little of this as possible.

Dr. Leven's views may create surprise, yet they are scientifically sound. Their fault lies in their being extreme. He rejects moderation. Where he recommends "do not touch this or that," experience replies, "do so, but sparingly." Cooked meat, without any additions, milk, broth, and some pulverized feculas do not irritate the stomach. All other aliments provoke inflammation or gastritis. Up to the present it was believed that the greater part of the troubles of the stomach were due, not to lesions in the tissues of that organ, but to functional modifications in the nutrition of the tissues, and that these modifications depended more on the state of the individual and his organism than on the organ itself. The latter, with Dr. Leven, is everything. Hence, there exists no individualities, no idiosyncrasies; all are equal before the membrane of the stomach. But the ner-

vous system is not affected in the same manner, with all individuals; sensations are not equal, nor are respiratory wants identical. The middle state, in which we live, and our occupations affect the stomach in its relations with food. A Parisian would certainly have an attack of indigestion if he lived like a peasant or an Esquimaux; he would fall ill were he to eat as much meat in Algeria as in the capital. These are facts corroborated by ages, and that no experiments on dogs can change. Those leading a sedentary life have not want of fatty food, but the peasant, living in the open air, requires a good deal. Then, in the process of digestion, other organs contribute as well as the stomach. The gastric secretion contains an acid which softens the food, and pepsine, which ferments it, thus preparing it for the action of the other secretions. What Dr. Leven appears to have discovered by his experiments is the important rôle played by the intestines in the work of digestion. Indigestion is not wholly due either to an aliment or an excess of aliments. Individual temperament has its disturbing place there. He is right in ruling that wine and liquors are not necessary to a good digestion; that we eat and drink too much, thus fatiguing the stomach, and adding no benefit to the organism; that we ought to masticate slowly and allow the food to be well incorporated with saliva, and thus obviate subsequent drinking. The doctor is equally correct when he proscribes veal, mushrooms, truffles, ice, stews, and all dishes having an excess of fat and sugar. He is too severe in condemning spices. At all times meals ought to be taken at regular hours, and their number diminished as we advance in age. It is good also to indulge in a moderate walk after meals, to burn what we have consumed, for, as Chomel has truly remarked, we digest as much with the legs as the stomach.

Another medical authority states that he invariably recommends sporting to those of his patients who are suffering from nervous affections, melancholy, or hypochondria. After a light breakfast on soup or coffee, they should set out early, and and consider their bag made for the day by noon; if perspiring, never rest in a damp or too shady place, as such might quickly produce inflammation of the lungs or rheumatism. To neutralize the sting of a gnat or mosquito, French sportsmen rub the part affected with a little *cerumen*, that is, the wax of their ear, extracted by the little finger. It is an effectual cure.

Meteorologists are still occupied with the late wet and cold summer, during which, according to M. Renan, as registered at his observatory in the Park of St. Maur, outside Paris, the readings of the thermometer during July last corresponded to the summers of 1758, 1795, and 1816. What is not less remarkable, the direction of the winds were nearly the same. The low temperature this season has not accompanied the northwest winds, but those from the west and southwest, which are naturally warm. M. Renan explains the matter as the consequence of the winds of Africa instead of passing westward, according to habitude, having deviated to the east of Europe. A corresponding phenomenon occurs at Senegal; the warmer the upper part of the river, the cooler is it at the sea side. M. Renan believes that severe winters are not the result of arbitrariness, but are constituted by groups

of four or six around one more vigorous, and which he calls the central winter. He attributes the grouping to cosmical causes; perhaps deviations in the march of thé winds might be nearer the truth. In any case, the alteration in the direction of the winds this summer has produced exceptional migrations of butterflies, which have invested the west of Europe since June, going southward. In some cases the sky was obscured by their passage, and they formed singed masses at the base of lamp-posts. They flew in groups, at the rate of ten miles an hour; if they encountered a wall, the column rose vertically till it was crossed; then, after a moment's hesitation, the march southward was resumed without a stop to repose on a flower. Strange, no butterfly of the same species in the locality over which the group passed joined the migration.

A student school-mistress, aged 16, was admitted into hospital, suffering from seuvre headache; she went to bed, and in the morning when she awoke she was completely blind. Dr. Abadie perceived that the surface of her body had become insensible; the forehead, neck, arms, and limbs, when touched with a lance, felt no sensation; no blood even flowed. He tried Dr. Burg's method, metallotherapy, and placed three pieces of gold on the left temple. In the course of fifteen minutes the patient commenced to see indistinctly; at the end of half an hour, perfectly, but only with the left eye, the right remaining refractory to the metallic treatment. The patient was next placed on the insulated stool of an electric machine, and some sparks were eliminated from the neighborhood of the orbit of the eye. In a quarter of an hour an amelioration was apparent, and continuing the plan every second day during a week, sight was restored.

M. Young has been studying the effects of poison on crustaceæ. Lobsters, cray-fish, and crabs are less susceptible to the effects of poison than vertebrate animals. They live very well in a solution of strychnine, because they eliminate it, but nicotine acts as rapidly on them as on us. New colors have been extracted from cabbage and coffee. Another is now announced, a magnificent red called *palmelline*, and obtained from an infusion of the red lichen which grows at the base of whitewashed walls, in damp places. The lichen resembles coagulated blood, and the structure of the little plant is very analogous to that of the blood of animals.

The ancients regarded the ocean as the cradle of life, and yet they only knew it from the beach; they had no means to sound its depths. Had they, it would have been found that the occupants of the ocean do not inhabit indifferently the depths. Some animals, as can be seen by the reflux of the tide, live about one yard below the mean level of the sea, others at three or six. The same remarks apply to the vegetation. During a neap tide quite new varieties of beings are revealed. Many mollusks that live under the tropics at small depths, extend to the coast of Norway and Newfoundland, in the profoundness of the Atlantic—at the entrance of the Arctic Ocean. In the Lake of Geneva, which is very profound, quite new species of animals have been dredged, some without eyes. M. Marion has been dredging the coast line of Marseilles, and has found many

rare specimens of plants and animals, those being largest which were taken at the greatest depths. The French Government contemplate appointing him to examine the whole coast of France, especially the Gulf of Gascony, which is a steep ravine, and its sides ought to be as rich in sub-marine life as the flanks of the Andes are in diversified vegetation.

In the Department of the Seine, of which Paris is the capital, the police registered during 1878, 508 mad dogs and 3 cats; 103 persons were bitten, of whom 36 were children; one-third of the cases were fatal. M. Galtier has devoted years to the study of rabies and concludes it to be incurable and surely mortal. He finds that rabbits can be inoculated with the virus, and in their case the madness declares itself more rapidly—from 4 to 18 days, than in that of other animals. Also, the saliva of a mad dog retains its virulence even if kept in water for 24 hours; hence, caution should be exercised toward those places where the diseased animals drink. It is a popular error to believe they shun water; they have to do so when the malady paralyses the muscles of the mouth.

The Medical International Congress at Amsterdam was as successful as it was interesting. The matters most debated were those connected with miasmas, ferments and germs. It is admitted that the latter exist in the air, are infinitely small and organic. Do they act by their chemical composition, as an altered organic substances, or are they microsopic beings, seeds, which in developing become pernicious? Wounds when treated by the antiseptic process—that is, excluding the air in their dressing, heal more surely and rapidly, but wounds exposed are cured not the less. Dr. Verneuil of Paris, advocates the necessity of preparing constitutions for operations—in diabetes for example, where the slightest operation may be fatal. He also recommended cancer patients to avoid the surgeons. Dr. Crosz of Vienna alluded to the terrible increase of syphilitic diseases in that city and among all classes of society. It is to servants, that is to say, to clandestine prostitution, that the evil is due; in one instance a whole family was infected by the utensils passing through the hands of a syphilitic servant. He urged that no servant be hired without the "moral" certificate being corroborated by one from a doctor. A Belgian physician claimed to cure phthisis by electricity; the Congress examined the more serious question of the efficacy of the phosphate of lime in consumption, to replace that so largely eliminated in theexpectorations. It was confessed that the utility of the phosphates was not clear. M. Marey demonstrated that shoes, &c., with little or no heels, are best, and that their soles ought to be larger than the feet. M. d'Arsouval exhibited a perfect instrument for measuring animal heat, during health, abstinence or disease. Another instrument registered respirations, during sleep, and which are fewest about five o'clock in the morning, and M. Markowitch has found the douche superior to the cold bath in typhoid fevers.—*F. C.*

ASTRONOMY.

ASTRONOMICAL NOTES.

FROM THE OBSERVATORY OF VASSAR COLLEGE.

(The computations in the following notes are by students of Vassar College. Although they are merely approximate, they will enable the observer to recognize the planets. M. M.)

POSITION OF PLANETS FOR NOVEMBER, 1879.

Mercury.—On November 1st Mercury rises at 8h. 4m. A. M., and sets at 5h. 27m. P.M.

On November 30th Mercury rises at 8h. 43m. A.M., and sets at 5h. 29m. P.M.

Mercury will be in conjunction with the moon on the morning of November 15th, and will be between the crescent moon and the horizon on the evening of that day.

Venus.—On November 1st Venus rises at 3h. 9m. a.m., and sets at 3h. 7m. p. m.

On November 30th, Venus rises at 3h. 8m. a. m., and sets at 2h. 33m. p. m.

Venus will rise nearly with the waning moon on the 10th, being in conjunctionwith the moon at 8 a. m. Although past the position of greatest brilliancy, Venus will be very conspicuous in the early morning during November.

Mars.—On November 1st, Mars rises at 5h. 33m. p. m., and sets at 7h. 51m. a. m. of the next day.

On November 30th, Mars rises at 3h. 5m. p. m., and sets at 5h. 12m. of the next morning.

Mars is in the best position in November, coming to the meridian at midnight of the 9th, at an altitude of more than 66°. Mars is in conjunction with the moon at midnight of the 26th.

Jupiter.—On November 1st Jupiter rises at 2h. 20m. p. m., and sets 55m. after midnight.

On November 30th Jupiter rises 29m. after noon, and sets at 11h. 10m. p. m.

If we examine the group of Jupiter satellites between the hours 8 and 10 of the November evenings we shall find the first satellite is hidden by occultation on the 5th, 12th, 21st and 28th, for some portion of this time; the same satellite is unseen, because in transit, on the 13th and 20th; it is unseen at the same hour on the 21st, because it is in the shadow of the planet.

The second satellite is passing across the face of the planet in transit during these hours on November 8th and 15th; it is in the shadow of Jupiter on the 17th and 24th.

The third satellite may be seen to enter upon the face of Jupiter between 9 and 10 p. m. of November 3; it will come out of the shadow of Jupiter between 8 and 9 p. m. of November 7th, and it will disappear by going into the shadow of Jupiter on the 14th.

The fourth satellite, which is the farthest from Jupiter, will reappear from behind Jupiter on the 27th, between 8 and 9 p. m.

All these changes are very easily seen with a small telescope.

Saturn.—On November 1st Saturn rises at 3h. 52m. p. m., and sets at 4h. 4m. of the next morning.

On November 30th, Saturn rises at 1h. 55m. p. m., and sets at 2h. 4m. of the next morning.

The ring of Saturn is now opening to our view, and with a small glass the spaces between ring and ball can be seen on both sides. The satellite Titan can be seen, and on November 7th will be found (with an inverting glass) on the right of the planet. It is possible that Rhea may be seen with an object glass of 4 inches diameter.

With the glass at the Observatory of Vassar College, on October 6th, the five small satellites interior to Titan were seen; Mimas, which is a very difficult object even with a large glass, was seen to move rapidly along the edge of the ring.

Uranus.—On November 1st, Uranus rises at 1h. 25m. a. m., and on November 30th at 11h. 31m. p. m.

Uranus is still among the stars of Leo, and not yet well situated for evening observers.

Neptune.—Neptune is in good position, but can be known as a planet only by aid of a good glass. It is among the stars of Cetus.

It rises on November 1st at 5h. 3m. p. m., and on November 30th at 3h. 6m. p. m.

Scientific American.

BOOK NOTICES.

THE MOUND BUILDERS. By J. P. MacLean, pp 243; Illustrated; Robert Clarke & Co., Cincinnati, O., $1.50.

Mr. MacLean is the President of the Archæological Society of Butler County, Ohio, and author of several works on Archæology. He has long been an ardent student and investigator, and having in his State one of the most prolific fields for original inquiry and research in the country, his experience is large and valuable. The results of his investigations among the ancient works of the Mound Builders of the Ohio and Mississippi Valleys, and especially in Butler County, are given in this small book in a particularly interesting, modest and convincing manner. Some of the chapters, such as those on their Advancement

in the Sciences, their Civilization and their Antiquity, contain new facts and will interest even old students of Archæology.

Everything which contributes in any respect to the solution of the long unanswered questions—who were they and what became of them? is valuable, and this work certainly possesses more than ordinary merit in this respect.

The mechanical part of the work has been handsomely done by the publishers.

THE INSECT WORLD, OR BORN IN PRISON. By Julia P. Ballard; pp 97; square 12 mo. Robert Clarke & Co., Cincinnati; $1.00.

This is a handsomely printed and beautifully illustrated volume, written in a fascinating style for the information, ostensibly, of children, but it contains much that will be of value to grown persons also.

The study of butterflies and moths is the principal subject treated, beginning with instructions how to catch them, how to handle and care for their eggs, larvæ, &c., with careful, minute, but untechnical directions for their examination and classification. The illustrations are very fine and are alone worth the price of the book.

REPORT OF THE COMMISSIONER OF EDUCATION for the year 1877. Government Printing Office, Washington, D. C.; pp 644; octavo.

An immense amount of work has been done and well done by the Commissioners' office in preparing this extremely complete and compendious Report, and so valuable has it been found that Congress at its last session ordered an extra edition printed. These have been thoroughly distributed and will be found of great interest to teachers and all classes of people devoted to or interested in education. At the close of the Report proper follows abstracts from the Reports of school officers of States, Territories and cities, statistics of all classes of schools and colleges, institutions of learning of all kinds, asylums, libraries, improvements in school furniture and apparatus.

Very few public documents deserve so careful a perusal by the people at large as this.

THE LIFE AND TRAVELS OF GENERAL GRANT. By J. T. Headley. 750 pp. octavo. Hubbard Bros., Philadelphia, 1879.

This work is, like all of Headley's writings, graphic in its descriptions, accurate in its statements, and as entertaining as a romance. It is designed to furnish a complete account of the life and remarkable public career of General Grant, and to take the reader with him in his brilliant tour around the world. This is a subject for which the pen of Headley is peculiarly adapted, and he has made the most of his opportunities. To those wishing a cheap and popular volume, which will at the same time be perfectly reliable, nothing can be better. For sale by John Kimmons, Agent.

A LECTURE ON PETROLEUM By Prof. P. Schweitzer, Ph. D. Statesman Book and Job Print., Columbia, Mo., 1879.

This is a 64 page pamphlet by Prof. Schweitzer, Chemist of the Missouri State University, at Columbia, Mo., and is a very complete and accurate digest of the subject of Petroleum, including its history, commercial importance, uses and danger, with an appendix giving statistical information as to its production, amount exported, quality of different oils, chemical compounds, etc.

Prof. Schweitzer has made up a very interesting and valuable monogram; one which will be highly appreciated by chemists and those dealing in and handling petroleum and its products.

PUBLICATIONS RECEIVED.

Laboratory notes from the University of Cincinnati; X. Some New Salts of Aniline, by Miles Beamer and F. W. Clarke; XI. Note on Lithium Picrate, by same; XII. Preliminary Notice of a new Volatile Alkaloid, by W. L. Dudley.

Reminiscences of Quantrell's Raid upon the City of Lawrence, Kansas, compiled and arranged by John C. Shea, editor and publisher, Kansas City, Mo.

Atti della Societa Toscana di Scienze Naturali, CXIII.

SCIENTIFIC MISCELLANY.

SCHLIEMANN'S LATE EXPLORATIONS.

Henry Schliemann's excavations, made from March 1st to June 5th, 1879, in the "Tombs of the Heroes," on the coast of *ancient Troas*, resulted in some important discoveries. Six of these tumuli were explored. The tomb of Ilus proved to be an agglomeration of earth. The tomb of Ajax, near the Rhœtean promontory, contained a few horse bones only. The greater portion of this artificial hill had been destroyed by the sea in a southerly hurricane. Only a few fragments of Roman brick were found in the tumulus near the southern extremity of New Ilium, and the conical mound on the sea-shore between the village of Yèni Keni and Yèni Sehir was found to consist of a natural sandstone rock. The fifth tumulus stood on a natural elevation 83 feet high, and proved to contain a gigantic quadrangular tower, probably of the Roman imperial epoch, standing exactly over a circular stone inclosure 4 feet 4 inches in height, and 34 feet in diameter, which consisted of well-fitted, beautifully cut polygons. This inclosure is supposed to be a sacred shrine, erected during the Macedonian epoch, the marks of an iron pick hammer being plainly visible on the polygons. The sixth tumulus, 66 feet high, contained ancient pottery, which was thought to be older yet than the one discovered at Hissarlik. A fragment of a vase bottom,

with incised characters, was sent to Professor Sayce, of Oxford, who wrote to Dr. Schliemann: "I do not think it is a real inscription, but it seems to me a bad copy of a cuneiform inscription, made by some one who did not understand the latter, like the bad copies of Egyptian hieroglyphics made by the Phœnicians." In the great trench excavated at Hissarlik, a large number of manufactured objects, large jars, owl-headed vases, an ivory seal, a trachyte idol, a treasure consisting of gold and silver rings, ear ornaments, etc., were exhumed. The orientalist, Emile Burnouf, and Professor Virchow were present at the excavations. A geological investigation of the plain of Skamander River proved that there were no marine, but only fresh water deposits, and that the theory prevailing among the ancient Greeks, that the sea had once formed a deep gulf in the plain of Troy, was unfounded. On June 19th, Schliemann left for Paris.—*American Antiquarian.*

LAWS OF ATMOSPHERIC ELECTRICITY.

Atmospheric electricity presents daily in Piedmont two maxima following the rising and setting of the sun, at an interval of some hours. These two maxima are separated by a minimum, which follows the passage of the sun over the meridian of the place. As regards the annual fluctuation, the maximum value of the atmospheric tension falls in February, and the minimum in September. Before and after storms the electrometer almost always marks zero, but during their passage or proximity the tension is very great. Rain and snow increase tension more slightly, and are often preceded and followed by electric diminution. The action of fogs, hoar frosts, and of the formation of clouds increases atmospheric electricity, though to a less extent than that of rain and snow. In calm and hot weather the lowest values are observed. South and especially southeasterly winds increase the electricity of the air; north winds have an opposite effect. Rain and snow are accompanied by negative electricity, at least as often as by positive. The same proportion holds good for storms, and to a less extent for rain and snow. Negative electricity is generally due to storms or rain at a distance, to the formation of clouds, or to a polar aurora. In the normal conditions of the atmosphere, electric tension decreases with altitude —*P. F. Denza.*

A NEW FIRE EXTINGUISHER.

Manufacturers of patent fire extinguishers are not likely to give a vote of thanks to the gentleman who first accidentally discovered, and then confirmed by numerous experiments, the fact that crude ammonia water, or gas-liquor, as it is called, acts like a charm in extinguishing a fire, no matter how inflammable may be the material upon which the flames have obtained a hold. The discoverer now recommends that owners of cotton mills, and other establishments where there is ordinarily great danger from fire, should have on their premises a stock

of about 1,000 gallons of this gas-liquor, stored in a tank or old boiler, mounted on brick work, and at such an altitude as to give a good jet service in case of fire. There is no reason why this cheap and efficient preventive of destructive conflagrations should not be generally adopted. It would seem that the extinguishing power of the liquor would increase with the augmentation of heat, as in all probability the ammonia would be more rapidly decomposed, freeing hydrogen and nitrogen gases in such quantities as would help to swell the volume of non-supportive gas, displacing the air, and so choking out the combustion. The theory of the discoverer seems reasonable, and is given for what is worth.

Boston Journal Commerce.

FLOWER GARDEN AND PLEASURE GROUNDS.

As the fall planting season is upon us, it maybe of service to remark that few persons seem aware of the great variety of the material with which their gardens may be adorned.

This winter, unless unusually severe, will be a very favorable one on vegetation, and those who plant at once will no doubt have unusual success. Even plants which have not been transplanted, but are usually regarded as somewhat tender, will probably suffer but little; still, protection of such plants will be in order as usual. It may be as well to remember that keeping off the cold dry winds is often a sufficient protection. Wherever earth can be used, as for instance in the case of small things, there is nothing like it for protection. Half hardy vines can easily be bent down and lightly covered, and small roses can have the young tops cut back and the earth drawn over them. When large they may be taken up, laid on their sides, and replanted in the Spring. In other cases used straw or some other light covering.

We have already spoken of the value of lilies and other Summer flowering bulbs in gardening, and that the Fall is the time to replant and care for them. The hardy or Holland bulbs, as they are often called, because mostly imported from Holland, where they are grown extensively and thrive better than in any other country, are almost the only ornament of the garden in very early Spring. Commencing with the Snowdrop, in this section in March or early April, followed by the Crocus, Hyacinth and Tulip, they make a most interesting sucession during the months of April and May, when but for them the garden would be bare enough. In addition to this they are unrivalled for culture in the house during the Winter months. As nearly all can be grown in so many ways—in pots, or baskets of sand or moss, or in vessels of water—they are an almost endless source of interest and amusement in every stage of growth. With a little moss from the woods or swamps, a few quarts of sand, some pots or a shallow box or two, and a few dozen Crocuses, early Tulips, Hyacinths and Narcissus, any one is prepared for a pleasant little Winter garden. Of course, a few Hyacinth glasses are desirable, but not essential. Very pretty boxes can be made with a little taste and patience, with some sticks and bark from the woods.

In addition to the kinds above named, the Anemone and Ranunculus are beautiful Spring flowers for all who have rotten cow manure to fertilize the ground with, and will give the beds a little protection from the severest weather. We are also very partial to the old Crown Imperial, of which there are now several varieties of red and yellow.

Many kinds of hardy annuals flower much better next Spring, when sown at this season of the year. A warm, rich border should be chosen, and the seed put in at once. Early in Spring they must be transplanted to the desired position in the flower border.

Few things are more valued in Winter than a bunch of sweet violets. A few may now be potted, and they will flower in the window toward Spring; or a small bed of them may be made in a frame, which should be protected by a mat from severe frost. To have Pansies flower early and profusely in Spring, they may be planted out in a frame, as recommended for the Violet.

Herbaceous hardy border flowers are often propagated in the fall by dividing the roots; but, unless it is convenient to protect the newly-made plants through the winter, it is better to defer this till spring, as the frost draws out of the ground and destroys many. Where it is now resorted to, a thick mulching of leaves or litter should be placed over the young stock when transplanted.

Chrysanthemums now in flower should have their names and colors rectified, against the time when in Spring they may have to be replanted, when they can be re-arranged with accuracy and satisfaction, according to the owner's taste.

Amongst the pretty effects which we have seen this year, have been several attempts at forming Winter gardens of evergreens. It was suggested in England a few years ago, that the massing system of growing flowers in Summer was objectionable in this, that it left the beds naked through the Winter. To remedy this, they had a reserve garden of evergreens, from which the plants were taken every year after the frost had killed the flowers, and set in the places where the flowers were. This makes the flower garden look green at least during the Summer season. This reserve garden of evergreens is usually put into an out-of-the-way place, and does not look very inviting in the Summer time. In the case we have reference to, the reserve garden had the evergreens set rather wide apart and the spaces between filled with Coleus, Achyranthus, and other colored and variegated leaves. The effect was very pretty indeed.

Over fifty patents have been obtained for cow-milkers, thirteen in England and forty in America. These machines have been divided into three classes. First, tube-milkers; second, sucking-machines; third, mechanical hand-milkers. The first are tappers, the second suckers, and the third squeezers and strippers. Some devices are formed of combinations of these classes. As yet no one machine can be considered a success, as notwithstanding the apparent success in single milkings, the constant use seems to forward a tendency toward drying off the cow.

Barrels made of paste-board have been introduced for the packing away of woolens and furs. These are seamless, and regarded as moth proof. The head, which fits down snugly, is the only available entrance for the moth, and directions are given to paste a layer of brown paper over this almost invisible line when the barrel is packed.

Mr. T. L. Phipson reports to the French Academy of Sciences the discovery of a new rose-red coloring matter, which he has succeeded in extracting from the little blood-red alga, found at the base of damp walls. It resembles no other known color, and exhibits considerable analogy with the hæmaglobine of the blood. It is the first time that a substance of this kind has been met with in the vegetable kingdom.

EDITORIAL NOTES.

THE twelfth annual meeting of the Kansas Academy of Science, of which Prof. B. F. Mudge is president and Prof. A. E. Popenoe secretary, will be held at Topeka, Thursday and Friday, November 6th and 7th, 1879. The business meeting will be at 3 o'clock p. m., of the 6th, at the office of Dr. A. H. Thompson, Kansas avenue, and the other meetings at the Senate Chamber of the State House. Numerous papers on scientific subjects will be presented. A full attendance of the friends of science is requested.

THE winter course of lectures before the Leavenworth Academy of Science was opened on the evening of October 23d, with an address by Dr. Tiffin Sinks upon the subject of a Visit to Vesuvius and Pompeii. The house was crowded to overflowing by the most intelligent people of Leavenworth, and they were well entertained.

The remainder of the course is as follows:

November 6th, Prof. W. E. Coleman—"The Records of Creation, Genesaical and Scientific."

November 20th, Prof. F. A. Fitzpatrick—"Moral Education in the Public Schools."

December 4th, Dr. W. W. Backus—"The Sun."

December 18th, Judge S D. Lecompte—"Skepticism, or the Isms of the Day."

January 8th, Prof. F. H. Snow, Kansas University—"Pre-Historic Man."

January 22d, Judge Robert Crozier—"Non-Partisan State Rights."

February 5th, Prof. Lawrence Hawn—"Belief as an Element of Science."

February 19th, Judge D. J. Brewer—"Municipal Indebtedness."

March 5th, W. S. Burke—"American Jurisprudence."

March 19th, Prof. J. M. Greenwood—"Value of Definitions."

April 2d, Dr. R. J. Brown—"The Mound Builders of Fort Leavenworth."

April 16th, Prof. B. F. Mudge, Yale College—"Geology."

April 30th, Prof W. W. Grant—"The Language of the Future."

Hon. Thomas P. Fenlon, Prof. H. D. McCarty, Rev. W. N. Page, Rev. T. W. Barry, and several other gentlemen from abroad, are expected to speak during the season, but are not yet prepared to announce dates or subjects.

THE regular winter session of the Kansas City Academy of Science commenced on Tuesday evening, October 28th, the proceedings consisting of papers upon Personal Hygiene and the Hygienic Construction of Buildings, by Prof. George Halley, and upon Potable Waters of Cities, their Beneficial and their Noxious Qualities, by Theo. S. Case. The

following programme for an extra course of lectures was arranged:

Pres't S. S. Laws, Missouri State University; Prof. F. H. Snow, Kansas University; Prof. F. E. Nipher, Washington University; Rev. Richard Cordley, Emporia, Kansas; Prof. G. C. Swallow, Missouri University; Prof. J. T. Lovewell, Washburn College; Prof. B. F. Mudge, Manhattan, Kansas. This course will commence in November. The precise dates and topics will be announced soon.

PROF. GEO. T. FAIRCHILD, who for many years has occupied the chair of English Literature in the Michigan State Agricultural College, has been elected President of the Kansas Agricultural College, at Manhattan. Prof. Fairchild is an able teacher and business man, and we congratulate the College Regents on choosing so efficient a president, as well as the Professor on this recognition of his abilities.

The professor chosen to fill the chair of Horticulture and Botany is a well known gentleman from the vicinity of Topeka, Mr. E. A. Popenoe, who is an enthusiast in entomology, and will carry into his work the zeal which his love for the study of natural history has created.

ON Sunday, September 28th, Prof. John Wise, the aeronaut, ascended in a balloon from Lindell Park, St. Louis, Missouri, with one companion, and has not since been heard from. The balloon was last seen about half-past eleven the same night by an engineer of the Lake Shore and Michigan Railroad at Miller's Station, thirty-five miles from Chicago. It was plainly visible in the bright moonlight, not very high, and was drifting northeastward over the Lake.

Prof. Wise was born in Lancaster, Pennsylvania, in 1808, and had made a practical study of aeronautics for over forty years. His last ascension was his three hundred and sixty-third. The fatal balloon was the "Pathfinder," and is described by the aeronaut's son, Charles E. Wise, as new and strong. It had never been used before. The bag was of material made expressly for it, and of the best quality for the purpose. The basket was one of the strongest, and was commodious.

The body of his companion, Mr. Geo. E. Burr, has been found in Lake Michigan, which leaves very little doubt of Prof. Wise's fate.

WE have received from Prof. G. C. Broadhead some interesting Notes on the Surface Geology of Southwest Missouri and Southeast Kansas, which we will give to our readers in the December issue.

PROF. E. L. BERTHOUD, of the Colorado School of Mines, writes as follows under date of October 8th:

"I have made, this summer, an exhaustive survey from Georgetown to Leadville and Lake Fork of Gunnison River, some 260 miles in all; have surveyed and leveled over seven passes in the Rocky Mountains, and can now say that, except South Pass, I have been over and examined every pass in these mountains, from Sun River Pass, Montana, latitude 48°, to the Cochetopa Pass, in latitude 38°."

PROFESSOR SPENCER F. BAIRD, U. S. Fish Commissioner, has recently received a well deserved compliment from the French "Société d' Acclimation," in the shape of a handsome gold medal appropriately inscribed.

THE readers of the REVIEW will do well to bear in mind the great meteoric shower of November 13th, predicted by Prof. Tice in the October number. If at all approximating what he anticipates, it will be a phenomenon rarely observed twice in a life-time.

URIAH A. BOYDEN, of Boston, bequeathed the greater portion of his property for the purpose of making scientific investigations of the properties of caloric and the phenomena relating thereto. When such investigations have been thoroughly made, he provides for observatories on prominent peaks, for the gratuitous use of students of astronomy and kindred sciences.

We learn from Mr. W. C. Evans, who has ust returned from Sedalia, that there is great interest being taken by the citizens in the discovery of mastodon and other prehistoric remains near that place. About ten wagon-loads have already been taken out by Messrs. Blair, representing, as is believed, no less than seven different animals, some of which, however, are probably recent. Some of the mastodon bones are very perfect, and undoubtedly belonged to a very large individual.

The authorities at Madrid say the loss of life by the floods in the districts of Murcia, Allicante, Almeria and Carthagena will exceed two thousand.

The Italians of St. Louis celebrated the discovery of America by Christopher Columbus on October 12th, in a very enthusiastic manner, all the different societies turning out for a grand parade with appropriate banners, and orations by the prominent leaders, the whole winding up with a grand ball in the evening.

NOTES ON THE PERIODICALS.

Patrons of the Review will bear in mind that they can save money in subscribing for any of the magazines of this country or England by remitting through this office.

The contents of the *Popular Science Monthly* for November are as follows: The Recent Progress of Solar Physics, by Professor S. P. Langley; Diseases of Wild Animals, by Prof. Jean Vilain; On Radiant Matter, I., by William Crookes, F.R.S. (illustrated), John Stuart Mill, IV., by Alexander Bain, LL.D.; Ocean Meteorology, I., by Lieut. T. A. Lyons, U.S.N. (illustrated); The Study of Physiology, by P. H. Pye-Smith, B.A., M.D.; Mythologic Philosphy, II., by Major J. W. Powell; The Evolution of a New Sense, by William A. Eddy; Why do Springs and Wells Overflow? by Nelson W. Green (illustrated); Mars and his Moons, by Prof. John Le Conte; Intellectual Straining in Authorship; Respecting Rubbish; A Reply to "Fallacies of Evolution," by George J. Romanes; The Inauguration of Arago's Statue; Sketch of Dr. Asa Fitch, by E. P. Thurston (with portrait); Editor's Table; Literary Notices; Popular Miscellany; Notes.

Harper's Monthly and *Harper's Weekly* are looked for by their readers with as much eagerness as ever, and are always found fully up to their high standard, which is on a constantly sliding upward scale. Additional excellences and improvements are promised for 1880.

The paper in *Appleton's Journal* for November likely to attract most attention is one containing a number of extracts from the "Memoirs of Madame de Rémusat," the appearance of which is the literary event of the day in France. Madame de Rémusat was maid of honor to Josephine, with whom she remained from 1802 to 1808, and so followed her in her imperial fortunes. The work referred to will shortly appear in Paris, but chapters from it have been published in advance in the *Revue des deux Mondes*, from which the extracts given in *Appleton's Journal* have been translated. This foretaste of the book will be generally welcomed. There are numerous other interesting papers, notably one on "The Malakani," a sect of so-called Spiritual Christians of Russia, which describes the striking features of their mode of life and their belief. The editorial department is always good.

The November *American Naturalist* presents the following articles to its readers, viz: How our Ancestors of the Stone Age made their Implements, by B. B. Redding; Colorado Plants, by Isaac C. Martindale; Mold as an Insect Destroyer, C. G. Siewers; The Fertilization of our Native Species of Clitoria and Centrosema, Wm. Trelease; Recent Literature; General Notes on Botany, Zoölogy, Anthropology, Geology and Palæontology, Geography and Travels, and Microscopy; Scientific News, etc.

THE *Atlantic* for December will contain a paper of marked interest and special value, embodying very recent observations on Farming in Kansas and Dairy Farming in Illinois, and presenting some startling facts with regard to the present and future of agriculture in the West. The readers of Rosamond and the Conductor will be curious to see the sequel of that affair in the Conductor and Rosamond. A very charming paper on Puritan Boston, founded on unpublished passages of the Sewall Diary; a sketch of three interviews with John Brown by Hon. W. A. Phillips, of Kansas, formerly correspondent from Kansas of the New York *Tribune;* an article on the National Board of Health; the first part of a curiously imaginative story in two parts, and a long poem of striking power, with a critical and biographical study of Turgenef from original sources, are some of the other attractions.

MAJOR BURKE, of the *Western Homestead*, has associated with him as co-editor and publisher our young friend D. A. Beckwith, who has been a newspaper man for several years, and is a live, active man and a sprightly writer. The *Homestead* has been a good magazine from the start, but this addition to its editorial force will still improve it.

THE Boston *Literary World* has absorbed the *Epitome of Literature*, published at Philadelphia, and will continue to be, as heretofore, the leading paper of its kind in the United States. Fortnightly, $2.

THIS excellent magazine, the Kansas City REVIEW OF SCIENCE AND INDUSTRY, now in its third volume, comes to us each month replete with the latest and best thought on scientific matters. Purely a western enterprise, it is a fitting reflex of the intelligence and genius of the empire that is so rapidly building up in this Mississippi valley. It has received recognition at the hands of the best writers in the domain of science, both at home and abroad; in fact, is sought for as one of the best mediums in the country for the promulgation of "the latest recorded triumphs of mind over matter." We urge scientific students to give this magazine a place on their tables, for without it they cannot keep pace with the development of science in the New West, which is now the great field of research.--*Chronoscope*.

THE articles in the Kansas City REVIEW OF SCIENCE AND INDUSTRY are by the best writers, and contain much of interest to the philosophical and industrial world. This serial only requires to be known to have a wide circulation, and should be read by every intelligent and educated person. We heartily recommend it to our readers.—*Exporter and Importer*.

The *North American Review* for November opens with a series of articles by Julia Ward Howe, Elizabeth Cady Stanton, Thomas Wentworth Higginson, Lucy Stone and Wendell Phillips, under the title, "The Other Side of the Woman Question." The second paper is an attack on Malthusianism, Darwinism and Pessimism, by Professor Francis Bowen, of Harvard College. The writer declares that Malthusianism has no advocates, that Darwinism stands completely refuted by the facts of nature, and that in the despair of Pessimism we witness the worst consequences of the Malthusian theory. This essay will be enjoyed by those who like discussion in which no quarter is given or taken. "A page of Political Correspondence," which follows is a collection of letters written by Mr. Stanton to ex-President Buchanan at the beginning of Mr. Lincoln's administration, and for the first time given to the public. Part IV of "The Diary of a Public Man" treats chiefly of the relinquishment of Fort Sumter. Mr. Seward's negotiations with Virginia, the progress of events at Richmond and Montgomery, and the plan of a peace convention. Professor Arthur L. Perry contributes a clearly written essay on "Tariff Reactions," in which he insists that every form of protection must operate calamitously in time. The concluding article is a review of "Some Recent Works of Fiction," by Edward Eggleston.

KANSAS CITY

REVIEW OF SCIENCE AND INDUSTRY,

A MONTHLY RECORD OF PROGRESS IN

SCIENCE, MECHANIC ARTS AND LITERATURE.

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GEOGRAPHY.

INTERNATIONAL POLAR STATIONS.

CAPT. H. W. HOWGATE, U. S. A.

The International Geographical Congress which convened in Hamburg in October, met for the purpose of securing harmonious action on the part of the governments and geographical societies of Europe and America in the work of Arctic exploration. Delegates were present from Germany, the Netherlands, Russia, France, Austria, Denmark, Sweden and Norway. England and the United States were not represented, but both are expected to coöperate in the plans of the Congress.

As a result of the deliberations of the Congress, a resolution was adopted recommending the establishment of permanent stations of observation in the Arctic regions at the following named places, and to be under the direction of the countries specified: First station, Eastern Greenland, to be maintained by Germany; second station, Jan Mayen, to be maintained by Holland; third station, Finnmarken, to be maintained by Norway; fourth station, North Spitzbergen, to be maintained by Sweden; fifth station, North Novaya Zemblya, to be maintained by Austria; sixth station, at the mouth of the Lena River, to be maintained by Russia; seventh station, *Lady Franklin Bay*, and eighth station, Point Barrow, both to be maintained by the United States; ninth station, Upernavik, in Western Greenland, to be maintained by Denmark.

It will be seen that foreign geographers appreciate the claims of the United

States to the northern portion of this continent, and assign them the lion's share of work, with a corresponding share of the honors to be achieved by a successful prosecution of the enterprise.

The selection of Lady Franklin Bay as the location of the most northern of the stations is an endorsement of the previous approval of this site by the geographical societies of France, of Bremen and of America, each of which had expressed a desire that our government should equip an expedition to establish a station at that point, as being the most favorable for the joint objects of scientific investigation and geographical exploration that could be reached or maintained at so high a latitude. The advantages to follow a systematic series of scientific observations within the polar area, are too evident to require extended argument here. To obtain profitable results from work done within this area, or elsewhere, it is important that it should be regularly and systematically done for a period of years. From observations long continued it becomes possible to deduce general laws for the guidance of future observers, and for the advancement of scientific research. Fragmentary series of observations, or those made for brief periods of time, however interesting in themselves, are practically valueless, and the time and labor spent in collecting them virtually thrown away. Work within the scientific field must be done with the same energy and persistence of purpose that is required to achieve success in what are termed the more practical pursuits of life. It is for this reason that the writer has advocated for several years past, the official establishment of a scientific station within the polar area as far north as it is practicable for a steamer to go annually without needless risk of life or property; and the maintenance of this station for such length of time as might be found necessary or desirable for the collection of reliable scientific data, and for the thorough exploration and survey of that portion of the globe lying beyond the limit reached by the English explorers of 1875-6.

The proposed location of the station is upon the shore of Lady Franklin Bay, in about Lat. 81° 40′, and near the winter quarters of the ship Discovery, of the English expedition. A fine deposit of coal exists at this point, which will furnish an ample supply of fuel for heating purposes, thus removing one of the greatest difficulties hitherto experienced in arctic exploration. This deposit of coal is easy of access, being exposed on the bank of a ravine for a distance of over two hundred yards. At its greatest exposure the thickness of the seam is twenty-five feet, but its depth below the level of the small stream that flows through the ravine is unknown, as no steps were taken by its discoverers to ascertain its extent. The coal was pronounced, after trial by the engineers of the Discovery, to be equal to that from the best Welsh mines. The exposed portion of the seam is at an elevation of two hundred feet above the sea level, and at a distance of about a mile from the shore of a small bay in Robeson Channel, and of four miles from the winter quarters of the Discovery.

Properly supplied with good buildings, abundance of provision, clothing and fuel, the occupants of the station would not be exposed to greater hardships than

have hitherto been surmounted by the intrepid explorers of the arctic regions, or by explorers of regions in much lower latitudes. There are no probable contingencies of weather or climate that cannot be foreseen and prepared for by using the experience of former expeditions, and the horrors of the long arctic night will in great part disappear before the kindly influence of improved appliances for comfort and amusement now available.

The lowest temperature reported by the English expedition as experienced at the site of the proposed station was —70°.8, which is not relatively colder than the temperature frequently reported by observers in Minnesota and other northwestern portions of the United States, and cannot of itself be considered an insuperable obstacle to the permanent occupation of the station.

Capt. Nares reports the existence of an unfrozen fresh water lake about five hundred feet above the sea level, near the seam of coal to which such frequent reference has been made, and the large amount of game killed by the crew of the Discovery while in winter quarters indicates the presence of sufficient vegetation to sustain animal life even during such exceptionally cold seasons as that in which the English wintered there. There seems to be no reason for doubting that the health and comfort of men can be secured at the proposed station as effectually and cheaply as at many of the frontier posts now occupied by United States troops.

With reference to the prosecution of surveys beyond the northern limit already reached, it is interesting to note that from the few observations already made in the northern part of Smith's Sound, it would appear the line of greatest cold is reached in about latitude 78° N., and that beyond that point the mean annual increase of temperature is a little more than two degrees Fahrenheit for each degree of latitude. If this proves to be true on closer and more extended observation, and the rate of increase continues to the pole, the climate there would not be incompatible with the existence of animal and vegetable life. In ordinary seasons it is not expected that there will be any serious difficulty in reaching the station by the aid of a steam vessel, especially fitted for the work, and the vessel can carry out annually supplies of fresh provisions, clothing, books implements, and if need be, fresh details of men, to replace those who may wish to be relieved. The work of observation and survey will furnish constant and useful employment for the men, and render them less liable to attacks of homesickness, after the first feeling of isolation wears off and they become accustomed to their surroundings and duties. With sledges, dogs, boats, and captive balloons, they will be enabled to avail themselves of any opportunity that may offer for pushing their way north—even to the pole itself, and thus settling finally the mystery now surrounding it. Aside from the object of geographical discovery—in itself a sufficient motive for the establishment of the station, the following are some of the benefits that it is expected will accrue to science by the work it will render possible:

1. With regard to a better determination of the figure of the earth, pendulum experiments are required in the region in question.

2. The magnetism of the earth requires for its better elucidation a larger number and more continued observations than have yet been made.

3. To complete our knowledge of the tides of the ocean, a series of observations should be made for at least an entire year.

4. For completing our knowledge of the winds of the globe, the results of a larger series of observations than those we now possess are necessary, and also additional observations on temperature.

5. The whole field of natural history could be enriched by collections in the line of botany, mineralogy, geology, etc., and facts of interest obtained with regard to the influence of extreme cold on animal and vegetable life.

All of the above named branches of science are indirectly connected with the well being of man, and tend not only to enlarge his sphere of mental pleasures, but to promote the application of science to the arts of life. There is scarcely a problem relating to the physics of the globe which can be fully understood without a knowledge of the phenomena within the polar regions. Whatever phenomena we may wish to investigate, it is of special importance to determine its maximum and minimum values, and in nearly all questions of terrestrial physics one or another of these values is found in the neighborhood of the pole. If, for example, we wish to determine the distribution of temperature upon the surface of the globe, it is specially important to determine the extremes of temperature, one of which is to be found near the equator and the other near the poles. If we wish to investigate the system of the circulation of the winds, our investigations would be sadly deficient without a knowledge of the phenomena in the polar regions.

If we wish to study the fluctuations in the pressure of the atmosphere, whether periodical or accidental, we cannot be sure that we understand the phenomena in the middle latitudes unless we know what takes place in the polar regions. If we wish to investigate the currents of the ocean, we find indications of currents coming from the polar regions, and it is important to be able to trace these currents to their source. If we wish to investigate the laws of the tides, we need observations from every ocean; and observations in the Arctic regions have a special value on account of their distance from the place where the daily tidal wave takes its origin. If we wish to study the phenomena of atmospheric electricity, and of auroral exhibitions, no part of the world is more important than the polar regions. If we wish to study the phenomena of terrestrial magnetism, observations in the polar regions have a special value, since it is here the dipping needle assumes a vertical position and the intensity of the earth's magnetism is the greatest. If we wish to determine how the force of gravity varies in different parts of the world, we require observations of the second's pendulum both where it is greatest and where it is least. In short, there is no problem connected with the physics of the globe which does not demand observations from the polar regions.

The subjects to which I have here referred are scientific rather than commercial, but many of them have an important bearing upon questions which affect the

commerce of the globe. In the attempts which are now being made by the joint efforts of the principal nations of the globe to determine the laws of storms, if we could have daily observations from a group of stations within the Arctic circle, it is believed that they would prove of the highest value in enabling us to explain the phenomena of the middle latitudes. Every winter, upon the eastern side of the Rocky Mountains we find an intensely cold wave moving down from the northward and spreading over a large portion of the United States. How can we fully understand the cause of the great changes of temperature which so frequently occur during the winter months, unless we know where this cold air comes from? And how can this be determined without fixed stations of observation extending northward over the polar regions?

The vast extension of the commerce of the world in recent times and its increased security are due in no small degree to more accurate information respecting the physics of the globe, including such subjects as the mean direction and force of the prevailing winds, the law of storms, the use of the barometer in giving warning of approaching violent winds, the surest mode of escaping the violence of a storm when overtaken by a gale, the most advantageous route from one port to another, the direction and velocity of the current in every ocean, the variation of the magnetic needle in all latitudes, and its changes from year to year, together with many other problems. And most of these investigations have been greatly facilitated by observations which have been made within the Arctic regions.

While the cost of establishing, equipping and maintaining the proposed stations is inconsiderable to the government, which has already its vessels, men and material that can be used for the purpose without adding a dollar to the annual appropriations, it is too great for the class of citizens most directly interested in the work, as they would be compelled to purchase outright everything required and bear the continued expense of ma ntenance, etc.

The work proposed is for the nation's honor and for the nation's benefit, and its cost should therefore be borne by the government. This matter I have urged upon Congress so often and so fully that further reference now seems unnecessary, except, perhaps, to say that favorable legislation will receive popular support, and will reflect honor upon its advocates and supporters. Let the necessary legislation be provided, and the United States be the first to carry into effect the wishes of the Geographical Congress.

AFRICAN EXPLORATION.

Professor Gerhard Rohlf's expedition, sent out by the German-African Society, having explored the Kufara Oasis, was there set upon and plundered. Prof. Rohlf was consequently compelled to return to Benghasi, though he hoped to receive help and compensation from the Turkish provincial government.

STANLEY'S LATEST PROJECT.

Mr. Donald Mackenzie has arrived in London from Cape Juby, and reports that the new settlement there is progressing very favorably. Sheikh Mohammed has built a house for himself at Cape Juby. Sheikh El Mohady, eldest son of the Sheikh Mohammed Ibn Bairook, accompanies Mr. Mackenzie on a visit to England, and has with him a native servant. Sheikh Mohammed Ibn Bairook is directly descended from Abd-el-Kader, and rules over some of the most important and powerful tribes in that part of the country. This is the first occasion that any of his family have visited England, and Mr. Mackenzie believes it will prove highly beneficial to the development of increased and permanent trade with the Soudan. A letter has also been received from Mr. Henry M. Stanley, the explorer. It is dated from Banana Point, at the mouth of the Congo river, September 13, and says:

"All this year I have been very busy and have worked hard. I have equipped one expedition on the East Coast, have reconstructed another—namely, the International, of whose misfortunes we have heard so often—and have explored personally several new districts on the East Coast. Having finished my work satisfactorily to myself, my friends and those who sent me, I came through the Mediterranean and around to this spot, where I arrived two years and four months ago, on that glorious day on which we sighted old Ocean after our rash descent of the Livingstone. And now I begin another mission seriously and deliberately, with a grand object in view. I am charged to open—and keep open, if possible—all such districts and countries as I may explore, for the benefit of the commercial world. The mission is supported by a philanthropic society which numbers noble-minded men of several nations. It is not a religious society, but my instructions are entirely of that spirit. No violence must be used, and wherever rejected the mission must withdraw to seek another field. We have abundant means, and therefore we are to purchase the very atmosphere, if any demands be made upon us, rather than violently oppose them. In some regions, experience tells me the plan may work wonders. God grant it success everywhere! I have fifteen Europeans and a couple of hundred natives with me."

GEOGRAPHICAL NAMES.

At a recent meeting of the Indian Council it was resolved by the Secretary of State that the "Hunterian," or "modified Jonesian system," should henceforth be adopted for all official purposes. This system is fixed in the *Imperial Gazetteer of India*, upon which Dr. W. W. Hunter is now engaged, and the printing of which is far advanced. At the same time Sir Barrow Ellis and Dr. Hunter, with others, have been appointed to represent India on the Committee of the Royal Geographical Society, which is engaged in introducing a similar measure of scientific uniformity into the spelling of names in the other countries of the world.

NEWS OF THE JEANNETTE.

The whaling bark Dawn reports from San Francisco that on September 3, within twenty-five miles of Herald Island, she saw the smoke of a steamer, supposed to be the Jeannette. About September 25, the ice began to open rapidly to the north; could not see any ice between us and Wrangell-land, and were much surprised, as the outlook was very discouraging in the first part of September. I now think the Jeannette will reach land, and we may expect to hear from her next year..

LOSS OF THE FLORENCE.

Information has been received that the schooner Florence, which formed the preliminary Polar expedition of Captain Howgate, in 1877–8, but since her return employed as a whaler, has been lost in Cumberland Straits, to the east of Hudson's Bay. She parted her chains and went ashore during a gale. Nobody was lost. The crew landed safely, but suffered subsequently greatly from exposure. They stripped the vessel, made tents of her sails, and stayed near the wreck for three days, when they were rescued by a passing vessel, which took two of them to Peterhead, Scotland, whence they came to this country by a State Line steamer. The remainder of the crew are expected in Scotch vessels at Peterhead, whence they will be sent here.

GEOLOGY AND PALÆONTOLOGY.

"ARE BIRDS DERIVED FROM DINOSAURS?"

BY DR. S. W. WILLISTON, NEW HAVEN, CONN.

I have read with interest an article in the August number of this magazine upon the above subject, by my friend Prof. B. F. Mudge. Unlike most writers opposed to the doctrine of evolution, Prof. Mudge's views are conscientiously drawn from purely scientific grounds, as a long and pleasant acquaintance with him fully assures me, and as such are worthy of careful consideration.

The confused state of general literature upon the palæontology of vertebrates, a science yet in its infancy, has led the Professor into a few misapprehensions, and I will here endeavor to give the views now held to sustain the Dinosaurian genesis of birds.

The relationship of dinosaurs and birds was pointed out and ably discussed by Prof. Huxley in 1861, and the replies of Prof. Owen are well known. The

additions to our knowledge of these extinct forms since then, though they may modify his reasons somewhat, have not destroyed their cogency. Anatomists, however, are not prepared to state the evolution of birds from dinosaurs as a geological fact, but its soundness as a theory, it seems to me, cannot be readily questioned.

The persistence of certain geological types is constantly adduced by its opponents as contrary to the belief in Derivation. That many genera, possibly species, of low forms have persisted, even from palæozoic times to the present, proves not that they were immutable, but that their surrounding circumstances remained the same—that they filled places in nature that no other types could replace. The true dinosaurs came into existence in the Triassic, and continued as a type to the very close of the Cretaceous, simply because in the struggle for life their place was not invaded; but, on the other hand, at any time during that period they may have given off branches that developed upward into birds, or, possibly, downward into the less specialized sauropoda. While some became birds, there was still a place for others as dinosaurs, and, as such, others filled it. That the type of dinosaurs should have progressed harmoniously into birds, as the child disappears in the man, at first sight may seem reasonable enough, but if we follow such views to their logical conclusions, the absurdity is apparent. If there had been no splitting, or divergence of types, man to-day would be the only form of life upon the globe—the result of harmonious progression from the lowest to the highest. Hence it will be readily enough seen that for dinosaurs to become extinct upon the appearance of birds, is precisely contrary to what we should expect.

But few now believe in the avian origin of the Connecticut valley Triassic footprints. They were undoubtedly made by dinosaurs and of highly developed forms, as their osseous remains show (*Megadactylus*). The earliest known birds are the species of Archæopteryx, from the Jurassic of Solenhofen. Hence, with our present knowledge, there was an abundance of time for a development to have occurred. These earliest birds, of which but very few species have been discovered, are of a far lower or more reptilian type than any now living, and have been properly placed in a distinct sub-class. The Archæopteryx was a bird covered with scale-like feathers, and possessed of reptilian-like teeth set in sockets, wings with four functional fingers, and a long slender vertebrated tail. The next forms of birds now known are from the Cretaceous, of which, probably, none can be classed among the modern forms. In the Hesperornis, from Kansas, we have birds with teeth and very rudimentary wings. Their bones were also solid, a peculiarity yet found in the penguin and allied forms. In the Ichthyornis, from the same locality and horizon, in addition to teeth, we find the neck vertebræ biconcave, a peculiarity reptilian as well as ichthyic.

The Professor errs in drawing any comparisons from the sauropoda. They are not true dinosaurs, and may eventually be entirely separated from the order.

It is very true that scarcely a single trait of structure runs through the whole

of Dinosauria; but that fact does not affect the relation existing between the most avian dinosaurs and the most reptilian birds. One would not compare a turtle with an eel to show the resemblance between reptiles and fishes.

About ten thousand species of living birds are known; but from the earlier geological ages we are acquainted with scarcely a dozen in any degree of completeness. As I have stated, these few forms are the most reptilian, and they certainly give us no reasonable grounds for supposing that other, and numerous, undiscovered contemporaneous forms were of the modern specialized types. While it may be said that there is not a single persistent typical element of structure common to both classes, it may also be said that there is scarcely a single persistent element of structure now known to separate them. As reptilian characters among birds, we have: long bones solid; wingless, or wings with four functional fingers; long, slender, vertebrated tail; slender, recurved teeth, set in sockets; vertebræ biconcave; ischial and pubic bones with free extremities; fibulæ free from tibiæ and descending well toward the tarsus; three toes, all directed forward, etc. As avian characters among the highest forms of dinosaurs: long, slender, very hollow bones; fore legs very short, feeble, and not used in locomotion; sacrum of numerous consolidated vertebræ; ischiæ and pubes directed backward and parallel; femora shorter than tibiæ and with fibular ridges at lower extremities; fibulæ slender and partially united to tibiæ (Marsh); astragali united to tibiæ (*Ornithotarsus*); three toes only. Many of these resemblances are important and can scarcely be called accidental. About the only persistent characters of any degree of importance among birds are the early ossifications of the pelvic and metatarsal bones.

Of the nature of the sternum among dinosaurs we have little definite knowledge. It, as well as the skull, is known in a very few species. That it may be birdlike in the true dinosaurs, is evident from the Sauropodous Ceteosaurus, where it is broader than long. Indeed, in Palæontology, we can predicate but little from the absence of any anatomical feature, as the clavicle among dinosaurs. Future discoveries may very materially change our pre-conceptions based upon negative evidence.

It is not difficult to understand how the fore legs of a dinosaur might have been changed to wings. During the great extent of time in the Triassic, in which we have scanty records, there may have been a gradual lengthening of the outer fingers and greater development of the scales, thus aiding the animal in running. The further change to feathers would have been easy. The wings must first have been used in running, next in leaping and descending from heights, and, finally, in soaring.

It is not necessary to suppose that birds came into existence before mammals, or even that the latter were derived from true reptiles. There is certainly no reason why lower types may not have succeeded higher ones. The theory of Derivation does not necessarily mean unbroken progression, but rather adaptation to circumstances. The absence of teeth among mammals may indicate degrada-

tion, for their presence and use usually require greater mental and muscular activity. The absence of teeth among birds is a specialization brought about by changed habits of life, and does not mean degradation. The rank of any species cannot be based upon any single detail of its anatomy, but only upon its assemblage and complexity of characters.

NOTES ON SURFACE GEOLOGY OF SOUTHWEST MISSOURI AND SOUTHEAST KANSAS.

BY PROF. G. C. BROADHEAD, PLEASANT HILL, MISSOURI.

The Ohio and Mississippi rivers are recognized as forming the southern boundary of Glacial agency in the Central States. Rarely along the southern bank of the Missouri river are found small boulders of igneous rocks, such as granite, greenstone and quartzite. In the States north of these rivers are nearly everywhere found accumulations of sand, gravel and rounded boulders, chiefly of igneous rocks.

In the western part of Missouri, and extending into Kansas, are found, along the valley of the Marais des Cygnes, occasional deposits of rounded flint gravel, in fragments not often larger than two inches diameter and generally of smaller size. These deposits chiefly abound on the hills or valleys at an elevation above all known high waters, and are often associated with reddish clay. In the eastern part of Bates county, Missouri, these gravel beds are found on high hills, 200 feet above the Marais des Cygnes valley, or 800 to 900 feet above the sea. Near Carthage, Missouri, a similar gravel bed is found 75 feet above the valley of Spring river.

In Miami and Anderson counties, Kansas, the gravel is very abundant on the upper terraces of the Marais des Cygnes river and its tributaries, at 30 to 70 feet above the valleys. In the western part of Miami county, on the ridge between the Pottawatomie and Marais des Cygnes, the gravel bed is 9 feet thick, and lies 50 feet above the valley of the Pottawatomie, and at least as many feet above all known high water.

On the Marais des Cygnes and its tributaries, in eastern Kansas, there are at least two well defined terraces, one at 20 feet to 40 feet above the stream, and the other about 50 feet above the first. The lower is richer alluvium; the upper valley, often wide spread, is of clay soil, overspread or else having just beneath the surface a deposit of water-worn pebbles. The receding hills are over a hundred feet higher. The elevation of the second terrace is about 900 feet above the sea.

South of Garnett, in Anderson county, Kansas, the gravel seems to be everywhere present at a general elevation of about 1,050 feet above the sea. In the valley of the Neosho river, at Neosho Falls, there occurs a deposit of sand and gravel of several feet thickness, lying at about an elevation of 1,000 feet above the

sea, or 30 feet above ordinary water in the Neosho river, or 8 feet above high water. Similar deposits occur near the Verdigris river, at Toronto, at about the same elevation above the sea and above all known high water of the Verdigris river. In the Fall river valley, at about 1,100 feet above the sea and above all known high water, there also exist deposits of rounded, flinty gravel. The quantity seems less at the western outcrops, and the elevation of the uplands above the sea level increases.

Now, whence this gravel, and how its presence?

Extending into Kansas from the south, along the lines of Cowley, Chautauqua, Elk, Butler and Greenwood, and northwardly, is a dividing ridge, known as the "Flint Hills," much higher than the country either east or west, and covered over with angular fragments of flint, chiefly of the age of the Upper Permian. The hills are mainly composed of limestone and shale beds of the age of Permo-Carboniferous, and form the eastern extensions of these rocks. It is probable that the rounded flint has partly originated from these hills, and is also partly derived from the other Upper Coal Measure rocks lying just eastward. The Coal Measure rocks of Miami county contain on the highest hills, a good deal of chert.

The elevation of the Permian ridge, above named, along the line of Cowley, Elk, Butler and Greenwood counties, varies from 1,550 to 1,700 feet above the level of the sea, being highest in the southwest corner of Greenwood, or 1,700 feet, and about 1,565 feet in the southwest part of Elk county, and not quite as high in the western part of Greenwood county.

These remarks are but preliminary, for these deposits require much study, and it yet remains to precisely determine their source and age. The pieces are rarely fossiliferous, but when any organic remains have been observed they tend to show the pieces to be derived from Coal Measure rocks. But the geological age is probably Later Glacial, or just previous to the Loess; but we have not now pos tive proof of that.

WESTERN KANSAS—ITS GEOLOGY, CLIMATE, NATURAL HISTORY, ETC.

BY EDGAR W. GUILD, MONUMENT, KANSAS.

It is still an open question whether the appellation of "Desert," as applied to the plains country of western Kansas and eastern Colorado, was altogether inappropriate. A succession of long and high divides, raised ages ago by a corresponding succession of internal waves, with long slopes on their south sides and breaking abruptly into short cañons on the north, devoid of timber and water, and covered principally with the short buffalo grass, cactus, and a stunted variety of resin weed, the grass not unfrequently dry enough to burn by the middle of July, certainly comes nearer to being a Sahara than an Egypt, and, to make it the earthly paradise that enthusiasts predict, will certainly require a thorough understanding of its atmospheric peculiarities.

From its geographical position, it is, and will be, subject to severe drouths—not so much from lack of adequate rainfall, for it is a region equally subject to severe storms, as from imperfect distribution, both local and geographical, coupled with excessive evaporation. There are dry spots during wet years, and *vice versa*, but it is too much a region of extremes for the golden mean to be often reached, and there are natural agents that to overcome will require persistent and intelligent warfare.

Assuming that rain is the only requisite, there is, with rare exceptions, sufficient yearly for vegetative purposes, could it come at proper times and be evenly distributed and less rapidly evaporated. But it is characteristic that when it does rain it comes in excessive quantities, is more or less local in its nature, and the result, usually, is a protracted dry spell for the locality favored.

The violent hot and dry south and southwest winds play a prominent part in checking vegetation, from the excessive evaporation they produce, not only from the soil, but also from the plant, thereby stimulating to the extent of overworking its organic system and producing a dwarfed, distorted growth, if not actual destruction. This is plainly evidenced by the timber of the region, which, though meager in quantity, is characterized by growing principally to crooked branches, and to low, scraggy, ill-nourished forms. Corn—and it must be true of any plant that presents a large surface above ground in proportion to its root—shows the destructive effects of rapid evaporation, even when the soil is not lacking in moisture. An examination of ground broken to a depth of ten or twelve inches, upon which no rain had fallen for six weeks, showed at a depth of three inches ample moisture for plant life under favorable atmospheric conditions; yet the plants there represented bore that unmistakable appearance of general debility so commonly met with higher in the scale of vegetable life.

Considering the country in relation to agriculture, the outlook is certainly far from prepossessing, though not beyond a partial solution. Excellent soil, particularly on high level divides, and land ready for the plow, are about the only natural advantages that can be claimed. Timber, for fuel and wind-breaks, will have to be raised, and water, though usually obtainable, is only found by digging to considerable depth. Water, and occasionally a few trees or bushes, can usually be obtained along the larger streams and their cañons; but the valleys are very narrow, and the inferior quality of the soil, it being largely composed of the washings of chalk beds, the limited quantity of arable land, together with distance from railroads, make this small portion of little significance when considered agriculturally.

Though offering so few inducements to the farmer as to make it well worth his serious study ere he attempt to found a home there, yet the region does offer great natural inducements for stock raising and grazing purposes. The short but nutritious buffalo grass, with which the greater part of the country is covered, is thoroughly cured before frost, a result of the dry climate, and affords a winter pasturage accessible at nearly all times. Water, along the streams, is plentiful

enough for stock purposes, and the high bluffs and deep, narrow cañons afford excellent shelter from the short but violent winter storms, while the vast quantities of grass-fattened beeves that are annually shipped are ample evidence of its adaptation to summer grazing.

Could the western one-fourth of Kansas have been set apart for stock purposes, it would have conduced far more to the general prosperity than if left open to a partial settlement from which no revenues, proportionate to the labor, will be received by the settler, and no material benefit accrue to the State. As a stock producing region it would have been unequaled, and, as such, would have added great wealth to the State and material prosperity to the farmers by affording them a permanent market for their surplus products, besides increasing the value of their land by inducing a more thorough settlement of the eastern portion of the State.

The western portion of Kansas can be considered as possibly agricultural to about the extent of the uncertainty of deciding where possibilities end and impossibilities begin. But it is questionable whether it is wise now to attempt the solution of the problem, since to make it a farming country is to build an uncertain empire on the ruins of another and equally important one, whose success is assured and whose limits are already sufficiently narrowed.

Many theories have been advanced to account for the absence of timber throughout the plains region, and no one of the many proves satisfactory of itself. It is only by considering them as a whole that their true value appears. The Third Cretaceous, which is the oldest formation exposed, gives but little evidence of timber or vegetation of any kind. It is, of course, impossible, with our present knowledge, to define the precise limits of the shallow Cretaceous sea, but certain it is that the western one-fourth of Kansas was nearly, if not entirely, inundated, and vegetation necessarily scarce. Further proof may, perhaps, be found in the fact that the animal life represented was essentially marine and carnivorous.

The Later Tertiary period (Pliocene?), which is comparatively recent, must have been more prolific in vegetation, if only to have supplied the vast number of herbivorous mammals represented, yet there is but little evidence of timber. If ever abundant, it must have been at that time, unless we accept the theory that the unrepresented divisions—fourth, fifth and sixth—of the Cretaceous, as well as all the Tertiary below the Pliocene (?), have been washed out, which savors too strongly of "catastrophism."

From the records, both past and present, we can only conclude that timber has been but sparsely represented during the million or more years that have elapsed from the close of the Cretaceous to the present time. It is certain that all vegetation was strongly affected during the upheavals and climatic changes which followed the close of the Tertiary, changes produced by the raising of the Rocky Mountains to essentially their present form, and the consequent drying of the fresh water (Tertiary) lakes. The scattering groves of gnarly, distorted cot-

tonwoods, which now constitute the principal timber of the western one-fourth of Kansas, cannot, then, be the lineal descendants of a once mighty race covering the same area of country, but, instead, are pioneers—and decidedly ill-used ones—pushed westward from the east into a region that now, as for ages past, affords more agents for their destruction than propagation. Nor is it probable, without human intervention to assist in combating their natural enemies, that any greater foothold will be obtained for ages to come.

The injurious effects of the annual prairie fires upon timber are so plainly apparent that they must be ranked first among the destructive agents. Could they be stopped, a period of ten years would make certainly a noticeable change in the valleys and cañons, though the improvement would be in quantity rather than quality, since checking the fires would not affect, to any great extent, violent hot and dry winds, which, producing so much evaporation, compel a tree to be either a brush heap or nothing.

In addition to the fires and scorching winds, there is Prof. Lesquereux's theory—which was proposed as a partial solution—of the extreme fineness of the soil of the valleys, it being here largely composed of the washings of chalk-beds. Undeniably, a soil of that class, presenting at nearly all times a hard, dry, unbroken surface, affords but little opportunity for seeds to germinate, nor would it furnish much nourishment to the plants; and even were they favored by excessive rains, which is sometimes the case, and so obtain a foothold, they would be pretty certain to succumb to the first dry season, since a soil of that class absorbs but little, and it requires a heavy rain to penetrate the unbroken sod to the depth of an inch.

In tracing the timber from the eastern portion of the State, where it is quite abundant along the streams, to the extreme western portion, where it almost entirely disappears, it is noticeable how persistently the cottonwoods hold on, solitary ones appearing for a considerable distanco beyond the little bushy hackberries, which are next in order of appearance. Proceeding east, the hackberries become more thrifty, followed by ash and elm, and by the time the oaks appear the streams are comparatively well timbered, the valleys have increased in width, and the chalk has disappeared, giving place to the harder limestone of the Fort Hays group of the Niobrara.

The persistency of the cottonwoods may be traced to the greater facility with which their seeds are transported by the winds, and their rapid growth, which enables them to get a sufficient start during a wet year to withstand a dry one. They are also less troubled with borers (beetles) than the hackberries, though that advantage is about offset by the injury they receive from porcupines.

The natural history of the region is too varied and extensive to admit of anything but a hasty survey. It is certainly surprising that a country so noted for its barrenness and lack of natural attractions should be so prolific in animal life. The few remaining buffalo are principally confined to the southwestern portion of the State, occupying a long, narrow plateau which constitutes the divide between

the Smoky Hill and Arkansas rivers. Though almost destitute of living water, there they remain, ranging west into Colorado, but rarely reaching Beaver creek, on the north. The locality is favorable to their preservation and increase, from its extreme barrenness. It is also a favorite retreat for large bands of wild horses. The stallions and many of the mares are as typical of their race as can be found, and they breed extensively. They are frequently captured, by a process known as "walking them down," which is usually accomplished by starting them early in the spring, and following them persistently, never running, but aiming to keep them continually on the move. By using grain-fed horses, the hunters have quite an advantage, and ten to fifteen days will tame a band so that they can be driven in any desired direction and corralled, providing the weather is propitious, the violent rain and hail storms so common to the spring-time occasionally stampeding a band when the goal is almost reached. Recently escaped horses, the property of emigrants, hunters and ranchmen, are frequently taken with them, and once a mare gets with a band she is most effectively herded by the stallion, and he will fight valiantly for her, nor permit her recapture until he is overpowered. The practice among buffalo hunters, when their horses escaped to the wild ones, was to shoot the stallion if possible; otherwise they stood but little chance of regaining their stock.

Antelope are very abundant, and fortunately these interesting animals are in no immediate danger of extinction. Eventually they will be domesticated for profit. Mule deer (*Cervus macrotis*,) are frequently met with along the Smoky River, the deep rocky cañons affording them excellent protection. They are not the true Blacktail, (*Cervus Columbianus*,) though usually so termed. Elk have disappeared since the influx of settlers drove them from the timbered valleys of the Saline River and its tributaries. Even when plentiful they were seldom met with in the portion of the State of which this article treats.

Of the carnivorous, there is a decrease in the two species of canidæ (*Canis occidentalis* and *C. latrans*), which were excessively abundant during the flush times of the buffaloes, though both are well represented yet, the latter more plentiful and less given to roaming and dogging the footsteps of the buffaloes than their big brothers—the grays. The swift *Vulpes velox* is the sole representative of the vulpidæ, as also are the skunk, badger and raccoon of their respective families.

During the summer of 1872 there was no little excitement caused by the prevalency of mad skunks. The epidemic reached its height the following season, and since 1874 there have been few if any cases in this region. Previous to 1872 skunks were avoided for obvious reasons, but not regarded as dangerous except to the olfactories. The many fatal cases since have put a brand on them that is likely to remain to the end of their race. They are yet regarded as far more dangerous to man than the rattlesnake, and well they may be, since the bite of the latter need not be fatal if taken in time and proper remedies can be had; while that of the skunk, *if mad*, is certain and horrible death in every case. There are said to be over fifty cases of death from skunk bite on record, and it is probably

far from an exaggeration. The causes which produce madness in animals, and particularly why inoculation should be so universally fatal, are as yet imperfectly explained. The trouble with the skunks may have been strychnia. The physiological action of the drug is of a nature to justify the supposition, and large quantities of it were used for poisoning wolves both before and during the infected period. The civet cat and red lynx complete the list of Carnivores animals. The former is very rare, the latter quite common.

Of Rodents, there are two species of rabbit—the jackass (*Lepus campestris*) and the cotton tail (*L. sylvaticus*). In addition, porcupines, beavers, musk rats, prairie dogs, spermophiles, moles, rats, and notably the remarkable jumping rat (*Zapa Hudsonia*), representatives being as usual far in excess of any other mammalian order.

Aquatic birds are abundant during migration wherever there are ponds of water. Three species of ducks (*Querquedula discors*, *Q. Carolinensis* and *Spatula clypeata*), occasionally remain through the breeding season, during which a great variety of terrestrial and aerial birds can be found. Of Waders, there are cranes, herons, stilts, snipes, sandpipers and plovers in abundance. Among the latter, *Aegialitis Montanus* is remarkable in spending the entire breeding season on the divides, completely isolated from water, while their near relatives, *A. vociferans*, are rarely seen away from that element.

Rasores are best represented by the sharp tailed grouse (*Pediœcetes phasianellus*, var. *Columbianus*), which is a resident, though never abundant. Quail occasionally appear, and prairie chicken are reported, though I have never positively identified the latter. The western range of both is limited from lack of proper food. The diurnal among birds of prey are represented by vultures, hawks, falcons and eagles, and four or more species of owls of the nocturnal. Scansores are limited to woodpeckers and the yellow billed cuckoo (*Coccygus Americanus*). Of the five species of the former the red headed and golden winged are most abundant. They are both adepts at catching grasshoppers, taking them on the wing as neatly as the fly catchers.

The varied and extensive order of Insessores is well represented, the more noticeable ones being the tyrants (*Tyrannus verticalis* and *Carolinensis*), mocking birds (*Mimus Polyglottus*), orioles (*Icterus Baltimorii* and *Bullockii*), Brewer's black bird (*Scolecophagus cyanocephalus*), horned larks (*Eremaphila alpestis*), meadow larks (*Sternella magna* var *neglecta*), cliff swallows (*Petrochelidon lunifrons*), and rock wrens (*Salpinctus obsoletus*).

Of the true reptiles Chelonia are represented by the soft turtles of the streams and the land or box tortoise. Testudo Lacertia by short tailed road lizards (*Sceloporus*), which are very common, and another handsome species with long and slender tail and the sides of the body striped with yellow and green. It is principally an inhabitant of the chalk slides. The most characteristic of the Ophidians are the rattlesnake (*Crotalus confluentus*) and the blue racer (*Bascanion flaviventris*), both of which are commonly met with on the highlands. The latter is preyed

upon by the California squirrel hawk (*Archibuteo ferruginea*). Mr. S. W. Williston has called my attention to a peculiarity of the blowing adder or hog nose (*Heterodon nasicus* var *simus*), which he thinks has never been noted, of opening the mouth so widely, when bothered, as to cause it to bleed. This action is usually accompanied by contortions which draw the body into a knotty ball that no amount of persuasion with a stick—an experiment I have often tried—will induce them to disentangle. There is the usual complement of grass and water snakes, the region not differing materially in that respect from the more timbered localities in the eastern portion of the State, the principal absentee being the copperhead (*Agkistrodon contortrix*).

Among Amphibia the most noteworthy species is one of *Amblystoma*, somewhat smaller than *mavortium*, which I have found together in the same pool, both in the larval or siredon state and in the adult.

Among insects, the plains most forcibly show a blending of Atlantic and Pacific fauna. The dryness of atmosphere and lack of abundant vegetation cause the true dividing line between eastern and western types—the Rocky Mountains having far less influence. A few characteristic forms among Coleoptera are the rare *Amblychila* and numerous species of cicindelæ, the *Asidæ* and *Eleodes*, abundant both in species and number, insects highly capable of withstanding dessication; and the many species of Meloidæ, most of which are probably parasitic upon the numerous Acrididæ; among Orthoptera, conspicuous forms of which are the walking sticks and clumsy locust (*Branchy peplus*). Among Hymenoptera, the burrowing wasps and Mutillariæ; among Diptera, the Bombylidæ and Asilidæ are especially noticeable.

In conclusion, unwonted enthusiasm has made Western Kansas a most fertile and prolific region—on paper. It is not the aim of the present article to disparage, but simply to note such facts as are apparent to the most casual observer. Mere local improvement, such as breaking a few hundred or thousand acres of sod, is not likely to produce any great change, beyond absorbing the moisture that does fall, instead of allowing it to be principally drained off, as is the case when the sod is unbroken. That the moisture evaporated from a given locality will return thereto in the form of rain, is highly improbable, to say the least, particularly when considering that it will be greedily absorbed by a violent wind. Like may attract like, but it is hardly an axiom; nor would it signify in this case if it were, since for surface moisture to influence atmospheric, it is first essential for the atmosphere to be charged with the same. It is practicably impossible for a cloud charged with moisture to pass through the warm and dry strata of air overlying the plains without absorption taking place, and it is a significant fact that clouds are rare unless accompanied by storms. Hence any increase in rainfall can only be brought about by a corresponding increase of rain bearing clouds. As the clouds must originate and obtain their moisture in other localities, it becomes evident that the climatic change promised Western Kansas would be universal to the extent of the region drawn upon to effect it.

MEDICINE AND HYGIENE.

DRINKING WATER IN CITIES.—ITS BENEFICIAL AND ITS DEADLY QUALITIES.*

THEO. S. CASE, KANSAS CITY, MO.

Just at present, owing to the unusual amount of sickness, chargeable to malaria and malarious influences, existing in the community, an inquiry into its possible causes will not be without interest. Although the word malaria implies simply an unhealthful condition of the atmosphere, yet it has by common usage come to comprehend all influences so affecting the human system as to produce certain classes of zymotic diseases which will be more particularly referred to hereafter.

The principal causes of such diseases are believed to exist in the water we drink and the air we breathe. This paper will be devoted to a consideration of the former, including a classification of potable waters in cities, an examination of their respective merits as regards their action upon the human system when of normal quality, their deleterious constituents when abnormally affected by the air and soil of cities, the effects upon the system of these deleterious constituents when taken into the stomach, conclusions drawn from these examinations, indicating the best and most healthful of the different waters for potable purposes, and finally an attempt to point such artificial means of purifying these waters as have been suggested by others and have occurred to myself.

Potable waters in cities are obtained from cisterns, wells and hydrants, and are usually regarded as comparatively pure in the order named—rain water being classed first, well water second, and river water third. How well this theory or belief is sustained will appear later.

A good, drinkable water is described as follows: "It is perfectly colorless and transparent, without smell or appreciable taste, but agreeable and not insipid or flat, does not lose its clearness by boiling and leaves a very slight residue upon evaporation." Drinking water, in addition to freedom from all organisms, from ammonia, nitrous acid and sulphuretted hydrogen, should not exceed eighteen to twenty degrees of hardness.

Rain water is naturally the purest of all for ordinary use; but unless special pains are taken in collecting and storing it, it is liable to contamination from a variety of sources, such as absorption of deleterious vapors and impurities from the atmosphere of localities largely occupied by manufacturing establishments, smelters of ores, etc., also from the dust, organic matters and other deposits washed from roofs into the cisterns; also from the salts of lead and copper dissolved out of the metallic roofs of buildings, and from foreign matters more or less offen-

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sive falling thereon and undergoing decomposition. Rain water is also, from its "softness,"—that is, absence of salts and chemical compounds—more liable to undergo fermentative changes than hard water, as well as more ready to form chemical combinations with metals, salts and other substances.

Well and spring waters, which usually contain variable quantities of the compounds of lime, soda, potash, magnesia and alumina, which are required in the economy of the system and which render them "hard," are in consequence of their sparkling and greater thirst-relieving qualities, more agreeable as drinking water than any other; but in cities are not only more liable to contain an excess of these salts, dissolved from the soil in passing through it, but are also far more likely to be contaminated to a highly dangerous degree by sewage, waste of factories, and other filth, which may be present in poisonous amounts without imparting to the water either unpleasant taste or smell, and even without discoloring it in the least.

River water is usually less soft than rain water and more so than well water, the latter condition being caused by the partial and gradual decomposition of its chemical compounds and the consequent deposition or precipitation of their bases. It is also far more largely contaminated by organic substances than either of the kinds of water before named, and is rarely to be found perfectly transparent in color or perfectly attractive to the taste. However, it happens that there are compensations in the case of river water which do not obtain in either of the others, and which result in its purification to a far greater extent than is usually known. Among them are the fishes, frogs and other living creatures and animalculæ which subsist upon the organic matters contained in it, and also the natural products of decay themselves, consequent upon their combination with the oxygen in running waters, such as nitric acid, which is itself antiseptic, carbonic acid, ammonia, etc., which escape from the water into the atmosphere. In addition to this it may be stated that even from the most populous cities the proportion of deleterious matter usually flowing into an adjacent stream, say one-twentieth in volume, is so small as compared with the whole volume of water itself, and is so purified by oxidation and other causes, that an analysis shows an astonishingly small quantity in a given amount of the mixture within a few miles from the source of the contamination.

Perfectly *pure water*, such, for example, as that derived from the melting of snow in the mountains, is believed to lack certain qualities demanded by the human system, and to tend at least to the production of goitre, cretinism and scrofulous diseases of various kinds. Whether this is so or not, it is well established that waters containing moderate proportions of the salts of lime and carbonic acid gas are more agreeable to the taste as well as more conducive to health. Hence, we conclude that in their normal condition it is probable that the waters of wells and springs are preferable for drinking purposes to either of the others.

The consideration of the *deleterious constituents* of the potable waters of cities is a work of no small importance, and requires more time than I shall be able to bestow upon it this evening. But I shall endeavor to be sufficiently comprehen-

sive in my remarks to excite an interest in the subject, which may result in some good to the community.

Cistern waters, as has been remarked, are liable to be contaminated by the gases, vapors and other impurities of the atmosphere, which will be admitted to be by no means inconsiderable when we remember that the vapor arising from the ocean contains common salt and perhaps other mineral constituents in sufficient quantities to render it medicinal miles inland, while over large cities, where numerous manufactures are carried on, the gases arising therefrom modify the lower atmosphere very perceptibly, as is manifested in their discoloring and destructive action upon the materials of which the buildings and other structures are composed. Such mineral ingredients, when found in rain water in a much greater proportion than in ordinary well water, i.e., in the proportion of more than fifty grains to the gallon, are necessarily injurious. But the principal sources of harm are the organic impurities arising from the decomposition of animal and vegetable substances, either washed in from the roofs or accidentally deposited therein, and from organisms floating in the air and precipitated by rain or snow. The former impurities may be filtered out or otherwise removed; but these minute organisms pass through all kinds of filters hitherto devised, and by their rapid propagation become the source of many diseases usually attributed to other causes. It is quite remarkable that some of these poisonous microscopic organisms are only found in closed wells and cisterns, while others are only found in those which are open and exposed to the action of the atmosphere. Among the deleterious organisms found in impure cistern water are Beggiatoa alba, schyzomycetes, the bacteria, monads, vibriones and all organisms free from chlorophyll and promotive of decompo ition of organic matter. Sanitarians differ as to the amount of organic matter, such as nitrates, ammonia, etc., which may be present in potable waters without rendering them unwholesome, but it is safe to say that when such contamination amounts to more than two or three grains of organic and volatile matter to the gallon, or ten to fifteen parts of chlorine in a million parts of water, such water should be condemned as unwholesome. And yet people drink with impunity, for years together, water containing larger proportions of organic matter than these. The answer to this is that "soil as well as seed" is required to produce a crop. The River Pollution Commissioners appointed by the British Parliament class as "suspicious" all stored rain water.

The water of wells is liable to be contaminated in a variety of ways without being affected in appearance, taste or smell, and it is not unusual to find, abounding in wells whose water has been regarded by those using it as especially pure, sweet and wholesome, the elements of the most virulent and deadly blood poisons. These impurities may in part be traced to animal and vegetable substances thrown into the wells from the surface, through carelessness or malice, but the most deadly of them unquestionably come from the leachings of sewers, stables and cesspools in their immediate vicinity. Public wells in crowded localities, and where horses and other animals are watered are most liable to such contamination.

I have in my possession the reports of a number of the Boards of Health of various cities in different parts of the country, North, South, East and West, and the unanimous verdict of them all is that most of the well water in cities is more or less contaminated by these means, and that in by far the greatest number of cases the outbreaks of typhoid fever, diphtheria and other zymotic diseases are due to the admission into the system of poisonous organisms by drinking well water impregnated with filth filtered through the ground in this way. The investigations of the British Health Commissioners elicited the fact that scarcely a well could be found in any of the beautiful, charming towns of England that was not an absolute source of disease to those using its waters, and that the older the town the more certain they were to find its waters thus contaminated and its death rate higher than in the newer localities. The researches of sanitary commissions in this country prove the same thing, and the reports from Providence, R. I., Rochester, N. Y., Dayton, Ohio, St. Paul, Minn. and Denver, Colo., all concur with the greatest unanimity in attributing the epidemics of typhoid fever, diphtheria, etc., which have scourged them respectively, to the same cause. In London an other disease has recently made its appearance in crowded districts, which is regarded as a new form of Cyprus fever, and chargeable to impure water.

The nature of the soil upon which a town, or any portion of it is built, has much to do with its healthfulness in the matter of well water. For instance: it is easy to see that a loose, porous or sandy soil is more readily permeated by fluids of all kinds whether deleterious or not, than a dense, compact and tenacious soil, and that the former is less likely to prove an efficacious filter than the latter. It is impossible to lay too great a stress upon this subject, and yet time will not admit of further discussion of it. In view of the fact that as a rule people are more fatally attached to their favorite wells than to any other of nature's gifts to them, it may be stated that some analyses made by the celebrated Dr. Frankland of well waters in England noted, famous, for their sweetness of taste, sparkling brilliancy of appearance, and supposed dietetic wholesomeness, revealed the fact that so great was the amount of organic impurity present that the water was actually worth in the market two dollars per ton as manure.

While such a degree of filth contamination may not exist in many localities in this country, still revelations have been made by laborers, in excavating for cellars and foundations of buildings, even in some of the cities of the West, which have too clearly pointed out almost equally disgusting and alarming conditions.

The British Commission before referred to classed as "dangerous" the water of all shallow wells. Prof. Phipson regards the presence of phosphoric acid in well and river waters as undoubtedly a bad sign; and Dr. Frankland concludes that the development of fungoid germs cannot take place without the presence of phosphoric acid, or a phosphate, or phosphorus in some form of combination, and that water, however much contaminated, if free from phosphorus, does not produce them. Hence, we have this, in addition to other poisons, to look out for in our investigations of drinking water.

The deleterious qualities of *river water* are derived both from the decomposition of animal and vegetable matters and also from the putrescent and putrescible substances carried into it by springs and brooks, sewers, drains from factories, etc., and consist of organisms similar to those described as existing in rain and well waters. To show to what extent the water of rivers is contaminated in passing by or through large cities it has been found by analysis that the Seine nearly doubles its proportion of mineral ingredients in passing through Paris, while its impregnation with organic matter is also largely increased. The river Thames receives so much organic matter from the sewers, factories, etc., of London as to render its waters below the city highly offensive, though above it its water is excellent in quality. Dr. Phipson analysed some water taken from the river Dart, which was so contaminated by sewage and refuse from chemical works that it poisoned and killed the fish. As above remarked, however, much of the impurity thrown into running streams is oxidized and rendered harmless within a few miles below the source of contamination.

Organic matters are largely present in all river waters, some of which are harmless even in large quantities, while the presence of others, such as putrid organic matter, numerous bacteria and micrococcus and minute white fungoid growths are, according to the best authorities, sources of immiuent danger. The presence of nitrous acid is also to be regarded as a very serious matter. The British commission already referred to classed as "dangerous" all river water to which sewage gains access. It may here be remarked that much of the organic and coloring matter found in river water is due to living green algæ and the products of the decay of leaves and other vegetable substances, which are comparatively harmless.

Thus it appears that each of these kinds of water is injuriously contaminated by the air or soil of cities to a degree and with a class of poisonsa lmost impossible in the country, and that the water of wells in cities is to be regarded with most suspicion.

Resuming the subject of potable waters in general, we take up the consideration of the micro-organisms, heretofore spoken of, as regards their deleterious action upon the human system. Professor Barnard in speaking of them says in substance: The Infusorians, whose unaccountable readiness to spring up wherever decaying organic matter existed, first suggested their name, are found chiefly in fresh water lakes, rivers, and smaller streams, where they multiply in myriads and are constantly swept about by the current. "It is commonly thought that pure drinking water is filled with these microscopic creatures and it is sometimes said that they constitute the life of the water. All this is the opposite of the facts. Pure water is not inhabited by organisms; on the contrary, stagnant or impure water alone affords them subsistence. They hasten the destruction of the dead animal and vegetable matters the waters may contain, causing for the time being an infusion or fermentation of the liquid in question." "While their devouring work is a 'bottling up' of injurious and infectious matters, thus purifying our

world, the substance their little bodies may contain and their parasitic action, when inoculated into the bodies of higher living organisms by contact, inhalation, eating, drinking, &c., render some kinds extremely dangerous as conveyers of the various contagious diseases."

It has long been taught by Prof. Austin Flint and others that the source of typhoid fever is a specific poison propagated through the alvine evacuations by contamination of the drinking water and atmosphere. The Boards of Health of Providence, Rochester, Baltimore, Cleveland, Dayton, Toledo, Minneapolis, Milwaukee, Denver and Savannah, now in my possession, and in fact, all medical authorities, agree that such is the case, and that as our cities grow older their citizens go on storing up elements of destruction which nowadays only develop here and there cases of typhoid fever, diphtheria and other dreaded diseases, but which, when the soil becomes impregnated beyond its capacity of neutralizing the poison and imparts it unchanged to the air and drinking water, will produce just such horrible epidemics as have been known in the crowded cities of Europe and the East.

They also agree that most of these diseases have their origin in living organisms that chemistry would wholly fail to discover. Dr. O. W. Wight, of Milwaukee, states the case thus: "A few spores, invisible to the naked eye, of some deleterious cryptogam may enter the stomach with the drink and there take root and increase into a growth of fatal disease. The ova of microscopic animalcules, or animalcules already full grown, may enter the system with drinking water and feed upon us till we die." Prof. Tyndall tells us that the spores of the *bacillus anthracis* killed nearly a thousand human beings and more than 50,000 animals in five years in the provinces of Norgorod. Dr. Detmers, of Illinois, discovered in his investigations of hog fever, or cholera, a new order of bacteria or bacillus which he believed to be the true seeds of this fatal disorder. This bacillus he determined by observation and experiment to be conveyed from one animal to another by means both of the air and the drinking water, which latter means of communication was conclusively shown by the fact that the course or progress of the contagion was down the stream in every instance, rather than the reverse.

It is apparent to all that the nature of the soil and the relative positions of the contaminating source and the well or stream, govern to a great extent the proximity that may be allowed between such objects. Shallow wells as a rule are more impure than deep ones. Wells, whose water comes from the surface of the first stratification of rock reached in digging, are naturally affected by whatever impurity gravitates into them. Wells in level ground without rock will drain a greater or less area, according as the soil is porous or not. Dr. A. N. Bell says that "the drainage of such a well extends from two to five feet in every direction for every foot in depth. Hence a well in compact soil, twenty feet deep will drain a circumference eighty feet in diameter; in a porous soil a well of the same depth will drain a circumference two hundred feet in diameter, the well being in the center."

It is generally believed that in passing or percolating through soils, especially those which are porous or sandy, the impurities of the foulest waters are removed, but such is far from being the case with the micro-organisms and subtle poisons resulting from putrefactive decomposition. These no filter can remove. This is clearly shown by the results of the chemical analysis of certain wells in the typhoid fever sections of Rochester, New York, by Prof. Lattimore. The soil underlying that city varies in density, but in all cases the water taken from these wells was clear, cool, sparkling, and contained no bad taste or odor, so that it might be regarded as thoroughly filtered, yet the analysis showed an average of 16.78 grains of common salt and large proportions of free ammonia and albuminoid ammonia; thus disclosing beyond any question the disgusting origin of the water, or at least of its eontaminating qualities.

I am indebted to Mr. Wm. Paul Gerhard, civil engineer connected with the water works of St. Louis, for the following results of sanitary analyses of well waters in different localities in that city made by him in 1878–9, as well as for for much other very valuable matter, to be used hereafter.

Location of Well.	CHLORINE. Grains per Gal.	HARDNESS.	ORGANIC MATTER.	REMARKS.
Franklin av. 2406	20	—	Traces: free am'a large am't	——
Broadway, 2123	11.8	31°	Marked	——
Franklin av. 2320	4.5	35°	Traces	——
Franklin av. 2400	20	46°	Traces	Total solids: 125 grs. gal.
Carroll Street .	28	—	———	
Fr'n av. cor 16th	16.5	—	———	——
Carroll Street .	32	—	———	——
(?)	16	—	Present: large amount of sulphuretted hydrogen.	——
(?)	22.5	—	———	——
14th St., No. 12	11.5	—	Organic Matter present	——

Prof. Paul Schweitzer, chemist of the Misiouri State University, at Columbia, Missouri, kindly furnishes the following results of analyses of well waters in that place:

LOCATION.	Grains inorganic matter per gallon.	Grains organic matter per gallon.	100 c. c. water requires c. c. permanganate of potash.
Rock Spring, University farm . .	21.2036	None	1.5
Mr. Loeb	27.9757	Trace	3.0
Mr. Batterton	66.1723	Trace	2.5
Prof. Ficklin	38.3573	Trace	2.5
Mr. Scruggs	36.2542	Trace	1.5

These two analyses show in a marked degree the difference in the amount of organic impurities in city and country wells.

Having thus examined the whole subject in a general way, the conclusions arrived at are that in cities fresh rain water, when obtained with proper precautions is the purest drinking water, river water next, and well water the most likely to be contaminated by dangerous substances and the most liable of all to deceive

consumers; but that all of them usually contain greater or less amounts of deleterious ingredients, and that some of them are disgustingly foul and unwholesome.

I may here pause to say that I have been favored with a few analyses of the well, cistern and hydrant water of this city by Prof. Patrick, of the Kansas University, and I am happy to say that he closes his statement of results with this remark: "From this examination it seems that the supply of Kansas City, except where contaminated by local impurities, is excellent." The water furnished him for examination was taken respectively from the hydrant in the Post Office, a cistern in the rear of Mr. S. K. Green's store, on Main street, and the public well on the corner of Fifteenth and Grand Avenue. The hydrant water is of course of the same quality all over the city, but we all see wells and cisterns every day which are so located that they can hardly be anything but certain receptacles for all manner of foul and filthy matter both from the surface of the ground and from drainage below the surface from sewers, cesspools, etc. And the experience of our own physicians, as well as those already referred to, is that the water from such sources is the cause, or if not the direct cause, then the efficient and prolific propagator of the virulent poisons so often heretofore referred to.

The question then next arises, what remedy can be applied to prevent the contamination of water in cities and by what means can such water be purified and rendered wholesome?

Of course nothing can prevent the contamination of water except the rigid enforcement, by state and municipal authorities, of the strictest sanitary measures regarding the cleansing of wells, vaults and cisterns, and the avoidance of draining sewage into lakes or rivers near the point of water supply. As these measures will probably not be carried out perfectly very soon, we may turn to the second remedy.

For the separation of ordinary impurities, numerous filters and precipitants have been suggested, of which I will name a few of the best.

1. A quantity of scrap iron placed in the water will most effectually remove organic matter, but the water must be subsequently passed through a bed of gravel and sand to separate all the oxide of iron which is formed.

2. Prof. Bischof, of Glasgow, proposes filtering the water through spongy iron and powdered limestone. The iron having been reduced from the ore, without fusion, to a powdery, spongy state, is placed in the upper portion of the filter and the limestone in the lower part. The iron removes all albuminoid and nitrogenized compounds and the limestone separates any trace of iron imparted to the water.

3. Major Crease, of the English navy, objects to the use of spongy iron and of animal charcoal, as media for filtering water for troops on the march, that the water passes through them too slowly, and recommends in lieu of both a filter composed of a newly devised carbonized material called carferal, which combines carbon, iron, and silicate of alumina and has been experimented upon and approved by analytical chemists; the result of their examination being the conclu-

sion that it is somewhat less costly than animal charcoal, is not injured by damp as spongy iron is, and does not require the water to be passed through a second medium.

4. Dr. L Lewin considers animal charcoal by far the best filtering material, for the reason that it not only holds back coloring matters and decomposes or partially retains most mineral, salts and gases, but it absorbs and detains the most varied organic compounds, nitrogenous as well as non-nitrogenous; its only drawback being its ready saturation with arrested impurities, so that it requires to be frequently renewed or revived.

Of precipitants, several have been proposed, and, as it is from these that in my judgment we have most to hope and expect, I will devote a few moments to their consideration.

1. Prof. Wm. Crookes suggested, in an article on the purification of water for the use of the soldiers in Africa, that the only substance that is practically available is sulphate of alumina, or common alum, as it has the power of converting all organized animal matter, living germs, &c., into an insoluble substance like leather, and probably of destroying their vitality; at any rate permitting the precipitate to be filtered out. This precipitation is much expedited by the addition of fine clay to the alumnia.

2. A mixture of alumina, clay and charcoal is used in England by the Native Guano Company, for the purification of sewage, with such success that the most offensive and foul smelling liquid is in a quarter of an hour converted into a bright, clear, inodorous, tasteless water, non-putrescible, and so pure as to allow the most delicate fish to live in it.

3. Prof. Crookes suggests another precipitant, consisting of one part of permanganate of lime, ten parts of sulphate of alumina and thirty parts of fine clay. This when added to London sewage in the proportion of twenty parts to the ten thousand purifies it completely in a short time. Foul ditch water can be purified with a much less quantity.

M. Jean de Mollins, who has dealt with the waste waters from the woolen mills of Raubaix, recommends milk of lime and sulphate of alumina, together or separately. He considers that the action of the aluminous hydrate upon the organic impurities of water is quite analogous to its behavior with dissolved coloring matters, which it throws down in the form of lakes. He also points out that clay, if diffused in water, becomes coagulated by the presence of certain salts and carries the organic impurities down with it. Many of our older citizens will remember the practice which prevailed in the days when we drank Missouri River water almost exclusively, in this city, of precipitating the impurities by means of pounded almonds thrown into it. Professor Tudesco says that "the organic cell, in contact with aluminous compounds, absorbs alumina with great avidity, losing its vegetative power and putting an end to the process of decomposition."

The most certain and destructive to organic life of all the antiseptics seems to be chlorine or some of its compounds. Prof. Ogden Doremus, of New York,

asserts that "chlorine gas, especially with the aid of moisture, which facilitates its action, can dehydrogenate (and thus destroy) any of the virulent spirits which result from vegetable and animal decomposition." Among the compounds of chlorine that are most likely to be harmless to the human system and at the same time effectual in destroying organic impurities in drinking waters, is hydrochloric acid, one of the most important factors in digestion, and a substance which possesses all the desired antiseptic qualities. To what extent it can be used in this direction remains to be ascertained by further experiment. So far, we know that a very small proportion of this acid (say 0.5 per cent) will prevent putrefaction, and that twelve drops to the ounce of water will speedily dissolve nitrogenous substances. This suggests the use of hydrochloric acid to aid the gastric juice in destroying organic germs in low forms of zymotic disease, where the digestive powers are greatly reduced, and thus preventing their escape from the body in an infectious condition.

Much might be added in the way of application, but enough has been said to draw the attention of those who have any regard for the health of themselves or their fellow citizens to the overwhelming importance of demanding from the authorities the enforcement of a system of sanitary rules and regulations which shall insure the absence from the cisterns, wells and reservoirs of the city, of the disgusting and poisonous organisms which have been mentioned, and in this way prevent the occurrence of sorrow-laden epidemics in our midst.

ASTRONOMY.

THE PLANET JUPITER.

WM. DAWSON, SPICELAND, INDIANA.

Jupiter is now a bright and evening star, seen easily in the southeast, half an hour before dark—a beautiful diamond star in the south at 8 o'clock. Its brightness is decreasing slowly, and will be least conspicuous in March, 1880. This is the largest member of our planetary family, being no less than 85,000 miles in diameter, and nearly 500,000,000 miles from the sun. When in opposition, i. e., on the opposite side of the earth from the sun, as was the case two months ago, it is about 200,000,000 miles nearer to us than when near its conjunction on the other side of the earth. And this makes quite a difference in its apparent size and in the visibility of its moons, or satellites, of which there are four. The contents, or actual size, of globes being to each other as the cubes of their diameters, a very little calculation shows that Jupiter is about 1,300 times larger than our own world; for the earth is 7,912 miles in diameter, and Jupiter nearly eleven times as much, and the cube of 11 is 1,331.

Moving around the sun at the rate of 30,000 miles an hour, it takes 11 years 315 days—fifty days less than twelve years—for this planet to complete its annual revolution around the sun—its own year. It rotates on its axis in 9 hours 55 minutes and about 30 seconds, making its day nearly ten hours long. Hence, Jupiter's year consists of 10,477 of its own days. The days and nights up there are equal, or nearly so, over every part of the planet throughout the year, the axis of Jupiter being about perpendicular to the plane of its orbit. The seasons also, are forever alike in the same part of the planet, being perpetual summer at the equator and everlasting winter at the poles. The great distance from the sun at which Jupiter is located would make the solar heat there twenty-seven times less than it is here. Yet a wise combination of the elements of air, clouds, etc., has, doubtless, adapted the climate of that country to the comfort and well-being of inhabitants who may dwell in that far off region of the universe. The rapid whirl of Jupiter on its axis causes a protuberance of the equatorial regions, making that diameter 5,000 miles longer than the polar diameter.

Although Jove, (another name for Jupiter,) is 1,300 times larger than the earth, yet he is much lighter in proportion to size, being only one-fourth as heavy, bulk for bulk. Then his actual weight, or mass, is about 312 times that of the earth; and, making allowance for his size and mass, it is calculated that the force of gravity, or weight of a body, on this planet is nearly two and one-half times as great as it is here. Hence, a moderate-sized man there would weigh more than 300 pounds.

A magnifying power of fifty, or even thirty, nearly always shows the appearance of one or two belts or dark bands across the planet. They are parallel with the Jovian equator and nearly parallel with the ecliptic (the earth's orbit). A considerable increase of telescopic power shows two or more belts quite distinctly. Sometimes they are connected at intervals by cross-bands and patches, thus giving the appearance of fringy, light spots along between the belts. These phenomena were conspicuous on the night of October 25th, 1879. High magnifying powers bring out a variety of detail, in which are found several belts and many forms of cloud-like appearances, some of a stratified arrangement and others of large and small patches of different shapes. The great forces at work there sometimes produce changes so extensive as to be easily perceived in twenty-four hours, or even less. Indeed, it is said that a large belt has been observed to vanish in two hours, and another to form equally suddenly. The cause of these belts has been referred to clouds thrown into parallel bands by the rapid whirl of the planet on its axis; or, perhaps more correctly, they are belt portions of the body of Jupiter seen between extensive masses of clouds which envelop a great portion of the Jovian surface. Professor Newcomb says: "From the changeability of the belts, and indeed of nearly all the visible features on the surface of Jupiter, it is clear that what we see on that planet is not the surface of a solid nucleus, but vaporous or cloud-like formations which cover the entire surface and extend to a great depth below. To all appearance, the planet is covered with a

deep and dense atmosphere, through which light cannot penetrate on account of thick masses of clouds and vapor." The professor's closing sentence gives a rather dark idea in reference to light on the immediate surface of Jupiter. However, he advances the doctrine that this planet is slightly self-luminous. He and Proctor both maintain the idea that great heat prevails on this planet. Let clouds and fire, and air and water, be as they may, I feel sure that the Creator has furnished this great body of the solar system for a beneficent purpose in the economy of creation.

Now for

THE NEW SPOT ON JOVE

which has been attracting so much attention for a month or two. My first special observation of it was on September 14th, when it appeared to be one-fifth as long as the diameter of the planet, and one-fourth as wide as long. It seemed nearly square, or straight across the ends, and of a darkish fine copper color. In two weeks the ends were extended in blunt points giving an elongated oval appearance. I do not observe any change since, unless it be an increase of length, which seems apparent. I agree with a writer in the *English Mechanic*, that "if this spot should eventually encircle the planet and become permanent, it would greatly add to its beauty." I estimate the area of this wonderful spot at about 100,000,000 square miles. It is not visible at the same time each night on account of the planet's rotation, being four hours earlier or six hours later every night. Professor C. W. Pritchett, of Glasgow, Missouri, has observed this spot quite a number of times since July 2nd, with a telescope twelve inches aperture having a fine micrometer and apparatus for accurate work. He locates the spot as in the 251st meridian and forty degrees south-latitude. He also reports it to be fourteen and one-half seconds long and four seconds wide. This would give an area considerably greater than that of my own estimate, but then I wanted to be within bounds, especially as it was partly guess-work at best. The color he calls rose-tinted, and says it is plainly visible in daylight, even when the sun is up. A spot similar to this, and believed to be the same one, was seen by Professor P. about the middle of last year. And, although he afterward looked at the planet many times, and very carefully, yet he failed to see the spot again for nearly a year.

But E. L. Trouvelot, of Cambridge, Mass., on September 25th, 1878, observed a spot of about the same size and color as the one observed by Mr. P. July 9th, 1878. And, to make the matter of sudden change more conspicuous, Prof. T. made a good observation and drawing of this same region of Jupiter, without seeing any trace of the spot, on September 20th,—only five days before the full appearance of that great country, which is more than five times the size of our whole American continent, and yet appears to us only as a clever-sized spot, and magnified 10,000 times at that. And if, as some suppose, this extensive territory should be a continuous mass of flame, or a deep gulf of burning gas, with what awful interest may we contemplate the wonderful works and power of God.

F. S. Davenport, of Jerseyville, Ill., had for some time been watching Jupiter carefully with a four inch telescope for "something new," and at 9:30 p. m., August 25, 1879, saw the new spot, appearing of a "decided pink color," and one-fifth as long as the planet's diameter, and one-fourth as wide as long—corresponding in size with my own estimate.

From several observations by different persons, it would seem that this spot has wholly disappeared from the face of Jupiter, and then reappeared, two or three times, within two years past. And observations in past ages indicate the formation and disappearance of large spots, as well as sudden changes in the belts, In 1664 a large spot appeared, by which Cassini and Hook discovered that Jupiter turned on its axis in 9 hours and 56 minutes. This spot seemed to vanish and reappear eight times between 1665 and 1708. In the years 1785–87, Schroeter observed extensive changes on the Jovian disk. Others again were conspicuous in 1835. Next to the sun Jupiter presents to our view more appearance of stormy commotion than we find on any other heavenly body.

But the crowning glory of Jupiter is the fine retinue of moons which are always moving round and round the parent orb, displaying their faces first one side and then the other of the great Jovian disk. These fine stars were discovered by Galileo soon after his invention of the telescope. But they were not described in the writings of Aristotle, and those people who believed that everything in nature was described by the old philosopher, discredited Galileo's announcement. One of them said "to see the satellites of Jupiter one must have a telescope that would produce them," but allowed his mind to change when he looked through the glass and saw them. Another savant with more caution would not look lest he should spy them and be convinced. He died soon after, and Galileo said in his witty, caustic style: "I hope he saw them while on his way to heaven."

One or two records exist showing that these delicate bodies have been seen with the naked eye. But such cases are very uncommon. However, a small spy-glass will show them, especially when in opposition to the sun. A telescope 1½ to 2 inches in diameter shows them as beautiful stars. And a view through a large telescope of Jupiter, with his belts and four satellites all in a row, is one of the most interesting sights that we find among the heavenly bodies. The orbits of these moons are all nearly in the plane of Jove's equater, which is nearly in the plane of our ecliptic; hence at every revolution they pass along this side the planet, and then are hid on the other side, excepting that the one farthest away, called the fourth satellite, sometimes passes a little to the north or to the south of the planet without being hid. The passage of a satellite over the face this side is called a transit; on the other side an occultation, and through the shadow of Jupiter an eclipse. This is generally to one side, east or west, of the planet. It is an interesting operation to watch one of these little diamonds pass into the shadow, appearing as though it were blotted out of existence, then reappear in two or three hours, continue visible for a few minutes (sometimes only one minute), then

disappear behind the planet, and finally show itself at the other side, ready for another round of unceasing travel. And these rounds are so precisely regular that they are computed and published several years in advance, giving the exact moment of the several transits, eclipses and occultations, and also of the moon's shadow on the planet, which often lingers behind the moon itself. The satellite, being about the same color and appearance as the planet, is rarely seen in transit, But the black shadow is prominent, and may be followed along near the belts with interest. Eclipses of these moons afford ready means of ascertaining our longitude, at least approximately. I find they occur about thirty-four minutes earlier at Spiceland than at Washington. Hence my longitude is about 8° 25′ west of our first meridian. In 1675 Roemer, of Denmark, discovered the means of ascertaining the velocity of light by these eclipses. As mentioned above the times at which they take place are computed beforehand. Now observation shows that they occur 16 minutes and 36 seconds later when Jupiter is farthest from the earth than when he is nearest—showing conclusively that this time (996 seconds) is required for light to pass across the earth's orbit, 184,000,000 miles, and this divided by 996 gives 185,000 miles for the velocity of light per second. Again I have often made time observations on these bright little orbs, by which to regulate my clock. In fact, the system of Jupiter with the oscillations of its moons from one side of the planet to the other, makes a grand time piece hung up in the heavens, keeping time for several worlds.

The names of the Jovian satellites are first, second, third and fourth, in the order of distance from the primary—first being nearest, and so on. The size of these "diamonds in the sky" is not far from that of our moon, the first and second being very near, while the third and fourth are some larger. And satellite first is about as far from its primary as our moon is from its primary—240,000 miles; but the great mass and consequent strong attraction of Jupiter causes it to revolve around the primary in one day and three quarters, equal to forty-two hours, or about four days and a quarter of Jovian time, which is the real lunar month of this moon. Satellite second revolves in twice the time of the first, and at about double the distance. The third satellite requires a week to make its monthly round—700,000 miles from its center of motion, while the fourth occupies near seventeen days at a distance of 1,250,000 in making a month of forty-one Jovian days.

These satellites, like our own moon, are believed to rotate on their axes in the same time that they revolve around the primary—thus always presenting the same side to the parent orb.

There exists a curious relation to each other of the motions of the first, second and third satellites by which they never can be all together at the same time; and hence never all eclipsed, nor in transit at once; and yet all four are sometimes invisible to us. Some may be on this side, some on the other side, and one or two eclipsed in the shadow of Jupiter.

The interest we feel in a coming eclipse of the sun or moon is well known,

particularly if it be nearly or quite total. Now let us imagine that we have four moons, the farthest and slowest of which makes an eclipse of the sun and is itself eclipsed every seventeen days, with occasional exceptions of longer periods. This would give about twenty eclipses of the sun and twenty of the moon in a year. The third or next nearer satellite would give a total eclipse of the sun and one of the moon every week, fifty-two of each in one year. The se ond satellite makes two hundred total eclipses in a year, half of them solar and half lunar. And the first satellite two hundred of the sun and two hundred of the moon. Then how many Jovian eclipses, think you occur annually? I calculate that a total eclipse of the sun and one of the moon occur there every day in the year on an average —but never two days without, and occasionally two in the same day. I have never till now made this calculation, nor seen it from any one else. If the numbers are too great, some one set me right.

Now that two eclipses occur every day, four moons are rapidly changing their places and phases, and all the brilliant stars that we see decorate their nightly skies, what scenes of true magnificence do the Jovites behold. Surely they might agree with David of old: "The heavens declare the glory of God, and the firmament showeth his handiwork"

The night there being only five hours long—from sunset to sunrise, and dark perhaps four hours—our people would hardly be satisfied with the time allotted for sleep. But again, it is as easy for the Creator to adapt the people to surrounding circumstances as it is to make a world.

THE LICK OBSERVATORY OF THE UNIVERSITY OF CALIFORNIA.

VISIT OF PROFESSOR S. W. BURNHAM.

It is now more than five years since James Lick, a millionaire of San Francisco, placed in the hands of certain trustees the magnificent sum of $700,000 for the purpose of erecting and equipping an observatory on the Pacific coast, which was to constitute the Lick Astronomical Department of the University of California.

As is usual in such cases, much trouble has ensued and nothing has been accomplished, so far; but the following extracts from the San Francisco *Chronicle*, of October 18, indicates that at last the trustees of this fund have concluded to commence operations:

The visit of Professor S. W. Burnham to this coast has determined, beyond any reasonable doubt, that Mount Hamilton, in Santa Clara county, will be the future site of the finest astronomical and meteorological station in the world. The site originally chosen for the observatory was at Lake Tahoe. Before making the second deed of trust, however, circumstances induced Mr. Lick to change his opinion of the advantages of the proposed site, and a series of experimental surveys were made, with a view of obtaining the best location within an easily ac-

cessible radius of San Francisco. The first place visited was Mount St. Helena, at the intersection of Napa, Sonoma and Lake counties. This mountain is 4,343 feet high, and has many of the atmospheric conditions essential to a successful observatory site. Mr. Lick was at first greatly pleased with Saint Helena, visited it in person and spent one night on its summit. Among other points visited was Mount Hamilton, thirteen and three-quarter miles in an air line east by south from San Jose. Upon learning that the highest peak of Mount Hamilton was considerably higher than the highest point of Saint Helena, while in other conditions, so far as known, the Santa Clara county eminence was fully equal to its less accessible rival, Mr. Lick determined upon Mount Hamilton as the final location of his most cherished scheme.

With James Lick decision and action were simultaneous. He immediately opened negotiations with the county of Santa Clara for the building of a road to the summit of Mount Hamilton. From Congress Mr. Lick obtained for observatory purposes two sections of government land; 175 acres were located with university scrip, and the donor purchased privately eighty acres of woodland. Of the 1,535 acres thus set aside for observatory use, only a small portion is essential to the immediate needs of the projected buildings, but the residue will be utilized for pasture and for fuel and water supply. The steep and broken character of the ground renders a large surface of land necessary for the adequate protection of the observatory against fire and from miscellaneous intrusion.

October 1, two years ago, James Lick died, after a lingering illness of nearly four years. Shortly before the death of Mr. Lick, Prof. Simon Newcomb, then resident astronomer in the Naval Observatory at Washington, was invited to this coast to carry out a series of test experiments on Mount Hamilton. Prior engagements made it impossible for Prof. Newcomb to close at once with the proposition of the Lick trustees, and his subsequent acceptance of the responsible and onerous charge of directing the "Nautical Almanac" put it out of his power to undertake a work for which he was eminently qualified. But, though he could not come himself, Prof. Newcomb was of lasting service to the trustees in suggesting the name of Prof. S. W. Burnham, of Chicago, with whom final negotiations were made last April.

Formerly a lawyer, and earlier a short-hand reporter, Prof. Burnham began about ten years ago to turn his active attention to practical astronomy. Being the possessor of a competence, he was enabled to carry on his researches independently, and for all his scientific labors, some of them of pre-eminent value, he has not received a single dollar either directly or indirectly. Beginning in the most quiet way, the young scientist made himself almost instantly a power in the world of science. His specialty has been and is "double stars." With an instrument of his own, a six-inch Alvan Clark refractor, he has discovered over 1,000 double stars, all of which he has catalogued, and the sum total of his labors in that single direction places him at the head of living discoverers.

Contrary to general belief, the visit of Prof. Burnham to Mount Hamilton

was not for the purpose of determining or assisting to determine the site of the observatory. That had been already determined, but the question of the size and character of the telescope to be employed was the objective point of his experiments. The language of the donor of the observatory provided that the telescope purchased should be the best in the world. At this day "best" means a good deal. Twenty years ago it did not mean so much.

Prof. Burnham arrived at Mount Hamilton August 17, and went at once to work. He brought with him his own six-inch telescope, with the necessary equatorial mountings, and a temporary observatory was at once erected. In shape, this temporary structure is a duplex-octagonal, with a dome-shaped roof, in which a narrow slit, a quadrant in length and about fourteen inches wide, leaves ample scope for the object-glass of the telescope. The dome is formed of bent gas-pipe covered with canvas, and rotates on iron balls, so as to allow the glass to cover every portion of the visible heavens. The building is about twenty feet in diameter, the sides being put together in movable panel sections. The observatory was made in San Jose, and is an extremely creditable piece of work. In the exact center is the telescope mounted upon a brick pillar capped with a granite block. The telescope is, as has been stated, the personal property of Prof. Burnham, and was manufactured for him some eight years ago by Alvan Clark, of Cambridgeport, Massachusetts, the most successful of all makers of refracting telescopes. The telescope is equatorially mounted on the true meridian. Its motion in following a given star is regulated in conformity with the velocity of the earth, or, in other words, the place of the star under examination is fixed. This end is attained by means of a driving clock regulated by the latest improved governor. This governor is a variety of the conical pendulum which vibrates in a circle and is brought back to a definite speed by a cylindrical brake. Almost every combination of mechanical force is brought into play in moving and adjusting the telescope, and the perfection of scientific mechanism is so nearly attained therein that there is almost no margin at all for improvement.

In order to determine the atmospheric conditions of the site, Prof. Burnham examined a great number of test objects. He has observed and measured a great number of double stars, has discovered about twenty new doubles, and has made day-time and night observations of a great number of prominent "naked eye" stars. He has also experimented with cutting down the telescope aperture, and has made many other experiments, all of which tend to confirm his opinion that Mount Hamilton is one of the best astronomical sites in the United States. Besides the freedom of the Mount Hamilton atmosphere from fogs and other astronomical difficulties and bugbears, there are facilities for seeing objects near to the horizon which do not exist in any station at present located in this country. According to Prof. Whitney, there is a broader sweep of horizon visible from Mount Hamilton than from any other portion of the State. Although the difference in latitude is not material, objects can be located several degrees further south than from the prominent Eastern observatories.

Up to the 27th of last month, Prof. Burnham had spent thirty-two nights on the mountain, and during this time all but five nights had been extremely favorable for observation. Although practically out of the Coast Range fog belt, an occasional gale blows the mist across the Santa Clara valley from two points—Monterey Bay and the Sandhill Gap, just south of the city. On extraordinary occasions this fog reaches the crest of Mount Hamilton, but ordinarily the sky is cloudless all summer, while in the East the average of clear nights is less than three per week.

The visit of Prof. Newcomb to the observatory, about two weeks since, was so highly satisfactory to him that he told the trustees he believed Mount Hamilton was the finest observatory location in the United States. The favorable opinion of Profs. Burnham and Newcomb is shared by Prof. Soule, of the State University. The practical results of the labors of Prof. Burnham, and the confirmatory opinions of his associate scientists, have made the course of the trustees straightforward and easy.

The next thing in order is "to order." There is plenty of margin for securing the very best work, as a glass of the projected size and quality will require fully three years in construction. Alvan Clark & Son have recently entered into contract with the younger Struve, of the Imperial Observatory at St. Petersburg, to furnish the object-glass of a 30-inch refractor at a cost of $32,000. The largest refracting telescope now in use is located in the Washington Naval Observotory, its object-glass being 26 inches in diameter. The exact size of the Lick Observatory telescope has not been determined, and will depend somewhat upon the success of the Struve glass. In order to properly observe the transit of Venus in 1882, the trustees purpose to secure at once a twelve-inch refractor, which will become a permanent fixture of the observatory.

The buildings necessary to the complete equipment of the observatory are as follows, though of coutse no definite plan has been decided upon: The observatory proper, which will consist of a single building, exteriorly connected with which will be a library, study, computing room and a sleeping room. As essential adjuncts to the chief observatory buildings will be a house for the astronomer in charge, another for his assistants, stables and various outbuildings, and a large building for the accommodation of the general public, which last building will doubtless be rented as a hotel.

The formation of the summit of Mount Hamilton is trap rock and porphyry, with croppings of a metamorphic slate lifted by later upheavals.

At the summit of Observatory Peak a space 120 x 260 feet will be graded to a depth of 25 feet. This will afford ample room for the observatory buildings proper, and the other buildings can be placed to advantage on a shelf of the hill lower down. The main observatory building will be about 70 feet in diameter. The foundation will be stone and brick, the walls iron and steel. The walls will be thirty feet high and the dome thirty feet additional. In addition to the large telescope and its smaller companions, there will be an equatorial, a meridian ci-

cle, and such other supplemental and accessory instruments as may be found useful.

During Prof. Burnham's sojourn on Mount Hamilton he has had the use of a number of meteorological instruments furnished by the War Department, and the result of his experiments has proved the excellence of the location as a future meteorological station.

There remains much to be done before the design of the lavish donor can be realized; but the trustees have their work well in hand, and it is more than likely that next year will see an active prosecution of the work.

METEOROLOGY.

SCIENTIFIC VIEW OF THE INDIAN SUMMER.

The delicious season popularly called "Indian summer," usually appears about the first of November in this latitude, and none of us need to be reminded of the enjoyable character of that exquisite part of the cycle of the season, or of that admirable balance of the terrestrial forces which bring to this region this genial portion of the year. Climatologists tell us that the area of its geographical extent not only covers the northern parts of the United States and Canada, but also of the far northwest.

It is certainly a very characteristic and periodical phenomenon in all these high American latitudes, as it is in Central Europe, though probably in a less marked degree; and there are reasons for believing that it exerts its softening influences up to the Arctic circle, tempering the first waves of winter cold that descend upon Arctic America. But it does not appear to lavish its charms on the far South or lower latitutes of the United States, where, indeed, they are not much needed. Although it is often prolonged into December, when a calm, hazy atmosphere fills the sky, through which the sun, shorn of its strength, sinks day after day, like a globe of fire, the Indian summer, at the Provincial Observatory, in Toronto, Canada, has been occasionally recorded as early as the 6th of October. The average date of its distinct appearance there, deduced from fourteen years' observation, is October 27.

Search for an explanation of this phenomenon has not escaped scientific investigation. As either pole of the earth is turned around the sun after the vernal equinox, and solar effect increases in the direction of that pole until a thaw of the winter's accumulated ice sets in, then an interval of cold occurs, caused by the rapid absorption of solar heat, and thus the frequent "cold spells" of the later spring months are accounted for. When, on the contrary, either pole is turned away from the sun after the autumnal equinox, the converse process takes place;

the higher parts of the continent are chilled, and the ensuing condensation of the vapor in the air liberating its heat, raises the temperature, and thus an interval of comparatively warm weather or "second summer" follows.

This simple explanation of Indian summer, first advanced by Admiral Fitzroy, is corroborated by the fact that the increase of temperature attending it is the greatest in the highest latitudes of America, where it is described as sometimes "oppressive"—just where, of course, the earth's crust in October is undergoing the most rapid refrigeration, where ice is forming, and consequently the heat of the condensation is most freely liberated from the lower atmospheric strata. The heat generated by condensation is familiar to all who reflect on their sensations when a shower is being formed in the clouds by this process on a sultry day. Were it not for the comparative dryness of the air in the interior of the continent, or rather if it were moist enough at this season, the cooling of the earth would produce clouds and rain, instead of "dry fog," as Indian summer is technically called.

The phenomenon in question has, it would appear, been more the theme of poets than of physicists. But of minor importance in a meteorological point of view as it may seem, its further investigation might furnish a clue to some problems of our climate which are yet unsolved The fine particles of dust which often fall on vessels in the open Atlantic, near the Cape Verde islands, when subjected to the microscope, have proved tallies on the winds, serving to fix the direction of the "trade winds" from the African coast, and thus clear up one of the greatest questions of ocean meteorology. Many not less striking examples of seemingly unimportant phenomena leading to important discoveries abound in the history of science.

We may, therefore, apart from the consideration of general interest, hope that the Signal Service will be able to give some attention to this beautiful feature of our autumnal weather. If the explanation of the phenomenon above given holds good, and "Indian summer" is consequently an expression or indication of the cold-determining forces of terrestrial radiation going on within the polar circle on the eve of winter, it would seem not irrational to inquire, might not full "Indian summer" observations in the fall of the year furnish meteorologists with one valuable clew toward forecasting the character of the coming season? Such a result realized would doubly repay all the labor and cost of the necessary research.—*Philadelphia Ledger.*

DIRECTIONS FOR SETTING UP THE RAIN GAUGE AND MAKING OBSERVATIONS

PROF. F. E. NIPHER, ST. LOUIS, MO.

It is important that the gauge should be placed at the ground, as stated in items 1, 2 and 3 of the printed directions. Trees around a gauge are *an advantage* if they are not too near, (see item 3,) as they keep the wind from striking the gauge. The gauge should be put where *snow does not drift in winter.*

Rain should be measured as soon after fall as convenient (to avoid evaporation), and *at noon if it is then raining*—the afternoon being credited to the next day. (See item 6.) These entries—the time of beginning and ending of rains, *and amount*, should be entered in the wide column of phenomena (or the back, if necessary), under their *true civil date*, the sum for the day being put in the rain column, as stated, thus:

•	DATE.		AM'T.	K. S.
	26	.²5a—6a=1.00 .10—12a=0.25 .12a—3p=0.30	1.25	•
	27	*9a—10a=1 inch snow =0.12 water	0.42	* •

Such a record will enable us to *identify* each rain, and will enable us to study its march over the State. We can thus determine where it travels most rapidly, and where it develops greatest violence. This work requires very little time, as it is not raining all the time, and its importance can hardly be over-estimated.

We are glad to have observers do all they can, but it is best not to undertake a greater variety of work than can be done *regularly* and *well.* We hope that no one will slight the rain determination.

Correspondents should write requests for blanks, etc., on a separate piece of paper, as when written on the blank, such notes are more likely to be forgotten. It should also be remembered that our correspondence is very burdensome. In case a letter is not answered, please remind by postal.

CORRESPONDENCE.

SCIENCE LETTER FROM FRANCE.

PARIS, October 15, 1879.

French doctors do not believe in the plague, and view the outbreak of the Astrakan malady as only a normal state of things, intensified by the consequences of war and its partner—distress. The march of the plague is frequently confounded with that of the cholera, while the spread of both is radically different. The plague is sedentary, has a predilection for certain regions, with no inclination, happily, to emigrate rapidly or far. Dr. Tholozan, physician to the Shah of Persia, almost predicted the "endemic," which, he wrote in 1877, prefers, like typhus or scurvy, its favorable *milieu* that war creates. The truth is that the plague has taken ten years to travel from Mesopotamia, Persia and Armenia, to Astrakan. Three years were required for its crossing from the south to the north of the Caspian Sea, though having every facility from land and sea traffic. It is right to note also, that, as usual, doctors differ as to whether it is the plague or a galloping

fever. In the mean time patients die, and the physicians even, succumb. The diagnosis of the disease coincides largely with the symptoms of the black fever which devastated Europe in the fourteenth century. The Russian doctors are not unanimous as to the manner of propagation of the plague. The contagion may be communicated by contact, or atmospheric germs. Now, in 1771 at Moscow, a great number of prisoners were coated with the blood of the plague-stricken and dressed in their infected clothes. Many of the subjects escaped death. However, it is generally believed that the dejections are the principal source of contagion in the case of plague as in that of cholera. Constitutions debilitated by misery, are the first prey for the scourge. The young fall victims more rapidly than the aged, women than men, corpulent than slender persons. Warm and humid climates are very favorable to the malady, and it is checked by excessive heat or excessive cold—but not always. In Nubia, where the climate is very hot Egyptian plagues are unknown. The plague is not peculiar as to a local residence. It is as much at home on dry lands as in deltas and marshes, as virulent in mountainous districts as in plains. Prudence, cleanliness and regular habits are the preventives prescribed.

In India there is a class of "spring finders," who pretend by placing their ear to the soil, to hear water oozing underneath. Stretched on their stomachs and listening with profound attention, they claim to hear the water murmuring. This acute sense of hearing is on a par with certain peasants who claim to discover springs with a divining switch, which bends in their hands when they come to a "strike." Their success is to be attributed simply to their knowledge of the region, and the declivity and position of the soil, as certain to have a subterranean supply of water, In volcanic regions many individuals can hear, more or less distinctly, rumblings in the soil. A gigantic trumpet placed against the side of a mountain at Bagrieres de Bigorre, enabled a gentleman to hear a succession of creakings inside the mountain. It was only natural that the microphone, which registers so strangely the most feeble sounds, that the step of a fly equals, relatively, the tramp of a horse at full gallop, has been effectively employed by M. de Rossi, a "volcanist," in his observatory at Rome. He has also the Seismic clocks, that automatcially register at each hour of the day and night, the intensity and direction of the earth's oscillations. By the side of these clocks is the microphone, connected as deeply with the soil as possible. M. de Rossi cannot foretell a catastrophe, but is able to detect three distinct kinds of noises, coinciding with the three special agitations proclaimed by the clocks. The explosions invariably precede the shocks.

Another curious phenomenon of sound is the singing book, now a philosophical toy. Thanks to M. Pollard, naval engineer of Cherbourg, it is within every intelligent person's reach. You place a small book on a table, the floor, or a chimney piece, and presently it distinctly emits songs, sacred and profane, or duets by a piano or harp, and violin solos. The book is composed of ordinary paper

leaves of the latter alternating with some of tin. The metal leaves are united, the last two with an electric current, thus forming a condenser. The top and bottom sides of the volume communicate with an electric wire running along the wall but concealed, and terminating in a pile in another room, where the speaker or singer &c., "deposits" the sounds of his voice in a wooden mouthpiece containing a metal plate and a stylus, which, touching a spring, sets free the electric current and transmits the sound to the book, where it is repeated—a phenomenon not yet capable of being satisfactorily explained.

Since twenty years ago the question of school furniture has assumed great and deserved importance—discussion, however, being chiefly limited to the form of the desk, the seat, and above all, the distance to be observed by the pupil between these two. The procrustean rule of having uniform desks and seats for scholars aged seven and fourteen years respectively, is unanimously condemned. Posture is a grave affair, for just as the twig is bent, the tree 's inclined. Either when reading or writing, the pupil ought to observe, like the soldier under arms, an attitude at once defined and calculated. Authoritative doctors state that much of the increasing short-sightedness in the human family is due to a vicious posture of youth when at school. M. de Bagnaux, in a conference on school fittings, recommends five models of seats and desks. The thighs of the pupil ought to rest on the full width of the seat, the legs to hang down straight, the soles of the feet resting well on the floor. The back of the seat ought not to be higher than the haunches, the desk naturally inclined and sufficiently near to the pupil so that the latter's body, without touching either the back of the seat or the desk, would be compelled to maintain the upright position. It is this "distance"—which ought to be as narrow as possible—that constitutes the grandest pedagogic disputes. M. Carnot's desk is in much request. It is constructed after a series of mean measurements of pupils, and to enable the occupant to easily stand up and also to regain his seat. When the pupil desires to rise, he pushes the desk on the slide before him, and draws it to him on sitting down. These hints ought to be noted for children who receive their early education at home.

It is well known that the inferiority of French cavalry horses is owing to their being underfed; it is now asserted that despite the augmentation of 1¾ ounces of meat to the daily ration of the French army, the soldiers are only a little less badly fed. The cause is attributed to the inferiority of the cattle purchased by the army contractors, who have to pick up all the lean and diseased kind wherever obtainable, to secure themselves a margin of profit. Meat is dear in France for two reasons—the large consumption of veal, and of stock killed before being fattened. It is proposed to supersede army butchers, and leave to caporals the right to purchase for their respective companies the meat wherever they find it best. There is a prejudice against the flesh of bulls and cows; this is mistaken, as when in a good state it is equal to that of oxen. All beef is good when it is fat—the sole test for goodness. Many persons in Paris prefer to pur-

chase the coarse parts of a fat animal rather than the choicest portions of a lean one; just as household bread is richer in gluten than the whitest loaves, where starch predominates. Siegert and Chemnitz have demonstrated that a fat ox contains in its flesh 39 per cent. of water, while a lean animal has as much as 60; hence, so long as soldiers are supplied with poor meat their extra allowances represent only an increase of water and bones.

Father Secchi's work on "The Stars," continues to be not only much read, but discussed. His labors with the spectroscope have enabled us to have clearer ideas about nebulæ, many of which do not contain solid stars, and are not so far from us as is popularly imagined. The "milky way" is a nebula, but of which our sun and its planets make a part, remaining on the outside of the ring, or coiled serpent-folds. Other nebulæ are beyond this one, including masses of stars of a similar order, and whose light takes 10,000 years to reach us, though travelling at the rate of 164,000 miles a second. Pére Secchi makes the ingenious suggestion that the imponderable matter we call ether, and by whose vibrations, under the form of light, we obtain notions of other worlds, is itself limited Thus there would be sidereal worlds, formed like ours, of nebular masses, existing beyond our ken, whose light can never reach us, being separated by spaces without ether, where absolute vacuum reigns, and plunged for our perception in the eternal unknown. Other universes, forever impenetrable to eyes and instruments! What an original and grandiose conception! Nor does the famous Italian astronomer consider these worlds to be silent and deserted; as life fills the universe it can also there exist, provided the temperature be not excessive; life, analogous but not identical with ours; life, associated with intelligence, even of a higher order than ours, for creation is graduated, and man may, after all, be one of the infinite degrees in the scale.

Professor Charcot has unexpectedly brought us back to the days of animal magnetism. He has effected some curious experiments on hystero-epileptic patients in the Salpêtrière hospital, producing catalepsy and somnabulism at will. The subject placed for a few seconds, or three minutes, before the full blaze of a drummond, or an electric light, becomes fascinated, the anesthetic state is complete, for he can be pinched, &c., without exhibiting pain. The members display no rigidity, and conserve whatever attitude is given to them. The patient has become cataleptic. In vain you speak to or question him, but the traits reflect the gesture, place him in a tragic posture, the physiognomy becomes severe, and the eyebrows contract; bring the hands together as in prayer, the visage softens, and the features become supplicating. Cut off the light, the patient drops into a somnambulistic or lethargic state; he falls backward, the eyelids close, and if the skin be now rubbed, the part will contract as if under the influence of electricity; touching thus certain nerves, the muscles of the face contort, and the head itself can be made to turn. Here is the somnambulism; call the patient he will rise up and walk to you; tell him to kneel and he will kneel; to write and he

write; to sew and he will, mechanically, like a slave, the eyes being firmly closed. Sometimes the answers given are more intelligible than when the patient is wide awake, so much is the intelligence excited. Blow your breath strongly on his face and the subject instantly awakens, after a slight throat spasm and some froth on the lips, but utterly ignorant of what has occurred. The experiment can be repeated at will. But the magnet, as Dr. Burg has shown in the case of metallic applications, plays an important part during the state of insensibility; the patient loses all sense of color; or, the colors of all objects become gray. Violet first disappears, then green, next blue, and last red. Double up the right arm, and it will rest so; bring the magnet to act on the left arm, in a short time the right one will regain its suppleness, and the left arm take the same contracted form. Music, strong bell ringing, can produce this anasthetic condition as well as the lights referred to; hence, the action of sound is identical with that of light. Steadily looking into the eyes will also produce the lethargic state. But this is treading on Mesmer.

There are many varieties of croup, up to its most dangerous form—according to some diptheria, when the whole body becomes infected with the disease, and death generally ensues. Dr. Teste, a physician of standing, reiterates that he has never failed to cure croups by means of bromium, since he first employed it twelve years ago. The remedy is simple: The one hundredth part of pure bromium, dissolved in distilled water; take every hour, and oftener if necessary, at the commencement of the disease, two or three drops of the solution, in a spoonfull of sugared water.

Vanilla came exclusively from the West Indies and Central America, till Messrs. Tiemann & Harmann discovered it in pine tar. M. Sèrullat now prepares vanilla by treating oaten bran, and subjecting it to a special oxidation; the product is the well-known perfume.

The Paris morgue is to be altered to something like an ice-house, and lighted by electricity; the bodies would thus be conserved longer for identification; also, *post-mortem* examinations are to be held in the amphitheater of the medical university, and in presence of the students and the representatives of justice. [F. C.

THE CLAUDE LORRAINE MIRROR.

WASHINGTON, D. C., Oct, 25, 1879.

EDITOR REVIEW: People of æsthetic tastes, it would seem, should be interested in whatever advances the knowledge and introduction of the beautiful. But oftentimes the beautiful is neglected because of notions of great expense connected with it or want of knowledge of its availability. When available however, it would seem that a genuine spirit of taste and culture would, through a little ingenuity or sacrifice, seek to possess it. Though our available funds for art

purposes be very limited, there are many things in this line which may be enjoyed by adding a trifing expense to a little ingenuity. Persons of genuine taste will show their artistic gifts whether they live in a palace or a hut; and oftentimes there is more pleasure in an inexpensive article made by our own personal efforts, than in some very costly affair purchased at the shops.

Some few years ago while out with an artist friend who was sketching from nature, we fell in with another artist who was on a like mission. He had with him what he termed a "Claude Lorraine Mirror," and allowed us to view nature reflected from it. The effect was most beautiful—the "mirror" lending a charm to the natural scenery far beyond what we had anticipated—rivaling the effect of looking into a clear unruffled sheet or stream of water, reflecting the surrounding beauties of nature.

Often when I have roamed amid the woods and come to a quiet, sheltered nook, where some small, lovely sheet of water was well protected from the winds, leaving its surface as smooth as the finest plate glass, and seen the surrounding objects reflected therein, mingled with the delicate water plants, twigs, stones and pebbles at the bottom, I have wished for some power to transpose such loveliness, or even to give us the power to apply it more universally. It seemed a hopeless wish, at least until I so accidentally fell in with a "Claude Lorraine Mirror." Then I was enchanted to find it within the power of the human mind to reproduce this effect at will; and that the instrument that would accomplish it was indeed most simple.

I judge, however that the "mirrors" are not very common, and that they are not at present within the knowledge and reach of many who would like to possess so simple yet wonderful an instrument. The one I saw was about seven inches square and was made of thick plate glass, slightly convex (as a whole plano-convex), for the purpose probably of improving the *relief* of the picture; the back and edges of the glass being blackened for the purpose of absorbing the light.

A common mirror will reflect, but then, for this purpose it would be too glaring, the light would not be soft and pleasant—subdued—like that reflected from the smooth crystal waters of the secluded vale.

Not being able to obtain one of these mirrors, the idea occurred to me that I might make a very fair substitute. So I procured a piece of heavy plate glass, about eight by ten, and tried an experiment. I blackened one side and the edges with japan varnish, giving it two coats for the purpose of securing a deep black that would absorb the light well; and to protect this and if possible add to its blackness, I pasted over the back some strong suitable paper, letting it cover the edges well. Then to make it a little more ornamental, covered this roughness with a neat, dark colored paper. The success of the home made mirror is complete and much better than could have been expected. The greatest expense was for the small piece of plate glass, which was infinitesimal beside the value of the object attained. These mirrors may be made of any size, and be protected by a case or box if desirable. Still, for carrying about, one eight by ten is full large enough.

Once having viewed nature reflected from a "Claude Lorraine Mirror," I think few persons of taste would be satisfied until they possessed at least so good a substitute as may be readily made out of a good piece of plate glass, as herein described. A little ingenuity and cunning handiwork will secure a most valuable addition to the private art treasures of the person of taste—one, I think, that may be used most universally and with the utmost satisfaction.

ISAAC P. NOYES.

HYPERIA IN THE NECTOCALYX OF ABYLA PENTAGONA.

EDITOR REVIEW:—Will you put this little bit of information in your next number?

The life of Hyperia and its brood in the barrel shaped body of a dead Doliolum is well known. Such Doliola, with crustacea within, are often taken in pelagic fishing. The larger nectocalyx of a Siphonophore Abyla pentagona may replace the Doliolum. I have frequently captured, in my fishing on the Piedmontese coast, in South France, specimens of such Abylæ with Hyperia and brood within. The upper and smaller nectocalyx of the Abyla was always detached. This nectocalyx, of course, never reached the dimensions of a large Doliolum, but it forms a perfect little house for the crustacean and its young. Only one end of this Abyla house of Hyperia has an opening, which is the natural entrance into the bell cavity.

J. WALTER FEWKES.

Cambridge, Mass., Nov. 12, 1879.

PROCEEDINGS OF SOCIETIES.

THE KANSAS ACADEMY OF SCIENCE—SYNOPSIS OF THE PROCEEDINGS OF THE TWELFTH ANNUAL MEETING.

BY PROFESSOR E. A. POPENOE, SECRETARY.

The members of the Kansas Academy of Science met at Topeka on the 6th of November, and occupied the afternoon of that day and the whole of the day following in the usual profitable manner. A business meeting was held at Dr. Thompson's office in the afternoon, when the customary reports were read and committees appointed for the business of the following day.

The lecture of the evening was delivered in the Senate Chamber, by Prof B. F. Mudge, the President of the Academy, whose subject was "The Mound Builders of America." The lecture was an epitome of our present knowledge of the habits and peculiarities of that ancient people, as evidenced by the remains of

their work in various parts of the country. The lecturer adverted to recent discoveries of mounds in Central Kansas, a full description of which he reserved for a paper to be presented the following day. The lecture was illustrated by a fine collection of typical implements and ornaments, which were examined with great interest by the audience, at the close of the President's remarks.

The sessions of the second day were devoted to the papers on the programme in the order given in the following synopsis of the proceedings:

Prof. Mudge read a paper on the "Metamorphic Deposits in Woodson County." The speaker's investigation of that formation had been conducted with special reference to finding the truth concerning certain reported discoveries of traces of the precious metals in these rocks Many features interesting from a geological standpoint were noted, but the observations made only served to confirm the belief, hitherto expressed by the speaker, of the extreme improbability of the occurrence of these metals in Kansas. The amethyst was added to the list of Kansas minerals from specimens discovered by Prof. Mudge in the deposits mentioned.

Dr. A. H. Thompson gave an account of a recent exploration of Indian graves near Topeka, exhibiting several crania and numerous ornaments as the results. The graves examined were located about six miles west of the city, on the farm of Mr. Rogers, near the old Baptist Mission, and are supposed to have been made by Indians of the Pottawatomie tribe. They were evidently a portion of what had been an extensive cemetery, situated on the brow of a terrace u on a hillside sloping westward toward a large ravine. The locality was covered by trees and bushes which had evidently grown since the formation of the graves. This would indicate an age of about forty years. A group of four graves was examined. In three were found only the skeletons of the Indians buried; but from the fourth were taken also a number of ornaments, evidently of civilized manufacture, consisting of bracelets, buckles and breastplates, or disks, of silver, and chains of brass, resembling cheap watch chains now sold. The metals were oxidized, and required much scouring before the ornamentation could be made out. The nature of the articles, and other circumstances, were thought to indicate the grave of an Indian woman of importance in the tribe.

The report of the Commission on Botany was made by Prof. J. H. Carruth, who had spent the greater portion of the summer in botanizing through several of the southeastern counties of Kansas. This locality had not been well explored previous to his visit, and the results were very satisfactory. About 120 species new to the Kansas list were discovered, and many important verifications of species hitherto reported but not seen by Prof. Carruth. The total number of species now known to grow spontaneously in the State will exceed 1,300, and constant additions are being made. Among the notable additions the speaker instanced the following: Water shield (*Brasenia peltata*), white water lily (*Nymphæa adorata*), flowering dogwood (*Cornus florida*), yellow honeysuckle (*Lonicera flava*), New York iron-weed (*Vernonia noveboracensis*), officinal lobelia (*Lobelia inflata*), a spe-

cies of blueberry (*Vaccinium vacillans*), cassina tea (*Ilex cassina*), trumpet creeper (*Tecoma radicans*), dwarf hackberry (*Celtis pumila*), swamp oak (*Quercus aquatica*, ?), yellow birch (*Betula nigra*), sweet flag (*Acorus calamus*), and two species of ash tree (*Flaxinus platycarpa* and *F. quadrangulata*).

A paper giving some of the results of the summer's observations in the field of Botany was read by E. A. Popenoe, who called attention to the tendency of certain wild flowers to vary in color from the normal shade to pure white. This tendency was noted in the blue phlox (*P. laphamii*), the blue sage (*Salvia pitcheri*), and some others. It was noticed in most cases that there existed a corresponding variation in the shade of green in the other parts of the plant, the leaves and stem being very much paler in the plants with white flowers. Certain hybrids between wild species of *Verbena* were noticed, new stations for rare plants recorded, and some species not previously known to grow in Kansas reported.

Mr. Joseph Savage described the sink-holes found in the southern portion of Wabaunsee county, where they occupy a district about four miles in circumference on the high prairie. They were described as circular in outline, with sides sloping from the margin to the center, where there was an opening into caves beneath.

Mr. J. R. Mead referred to similar sink-holes as being very abundant in Butler county.

Prof. Mudge described a very remarkable one located in the southwestern portion of the State, about fifteen miles from the Cimmaron salt region. This, he stated, was 200 feet in diameter, about 60 feet in depth, and two-thirds full of water strongly impregnated with salt. The sides were perpendicular, and the cavity was apparently left by the direct vertical subsidence of a mass of earth of the volume and dimensions indicated.

Prof. Mudge also gave a brief description of some caves situated in the southeastern part of Kansas, and recently explored by him. They were found to be of considerable horizontal extent, high and narrow, and abounded in stalactites.

Mr. Savage exhibited the results of an examination of some coal deposits near Independence, Kansas. Among them were some fine specimens of carboniferous plants, a beautifully preserved *Sigillaria* of an undescribed species being especially noteworthy.

Prof. Carruth described the deposits of mineral paint that occur near Fort Scott. This paint is said to exist in thin layers in beds of shale, and occurs in three distinct colors—black, white, and red, or light purple. The red is oily to the touch, and all three colors, when mixed with oil, are used for marking cattle.

A paper was read by Hon. F. G. Adams, of Topeka, on the phonetic representation of Indian language, describing the systems or alphabets invented by the Cherokee, Sequoyah, and by Mr. Meeker, a missionary who formerly resided in Johnson county. The alphabet formed by Mr. Meeker was said to be adequate to the perfect phonetic representation of any Indian language, and books were printed in the characters of that alphabet in eleven different dialects.

Mr. J. C. Cooper presented his notes on a recent visit to the Cerillos mines, in the vicinity of Santa Fe, New Mexico, graphically describing the geographical, geological and agricultural features of that country, and the peculiarities of Mexican civilization. He considers the valley of the Rio Grande as a region of vast agricultural importance, when irrigation shall be employed to overcome the present aridity of the soil.

Prof. Carruth read a paper on the "Elementary Sounds of Language." This paper consisted of a minute analysis and classification of the various elementary sounds in the modern languages, and evinced an extended knowledge of the subject on the part of the speaker.

Remarks were made by Mr. F. E. Stimpson on the comparative values of substances used for fuel. He described the manner of using damaged or weedy hay and stubble for fuel as practiced by a miller in Hutchison. A careful comparison of the results obtained by the use of hay as against the use of coal in the mill furnace showed in favor of the former, while the daily expense for hay was $2.50 and the cost of coal for one day's firing was $6. The estimate of the daily cost of hay included the wages of a fireman required to feed the furnace, the engineer doing the work of fireman where coal was used.

The evening session was opened by Prof. Mudge, who read a paper descriptive of recently discovered mounds in Davis and Riley counties. The following abstract is furnished by the writer of the paper:

"Quite recently Major J. W. Powell, when on a visit at Junction City, called the attention of John Davis, Esq., of the Junction City *Tribune*, to several mounds on his farm that appeared to be the work of the Mound Builders. Two weeks ago one was opened and found to contain human bones, pottery in fragments—which were clearly of the quality made by that lost race—with arrow-heads, a pipe and beads. The mound was about 30 feet in diameter and but 3½ feet in height, composed largely of stone of all sizes from one to forty pounds in weight. The rocks, bones and implements were all thrown together in the utmost confusion. The bones were in all parts of the mound, from the bottom to the surface, and had evidently been exposed in some other spot and afterward collected and buried here. This was indicated by the broken condition of the bones and the frequent marks of the teeth of wolves. No important part of a skeleton was whole, but the number of teeth, etc., indicated at least four persons, including a child of fourteen years of age.

"The pottery was in fragments, and also scattered in all parts of the mound. Some of it was thick and coarse, and some portions thin and of good workmanship. While I was present, twenty-five or thirty small pieces were thrown out, which I decided to be from one vessel. A portion of this we fitted together, which indicated a neat ornamented cup which held about a pint and a half.

"The beads were about one hundred in number and of four kinds. Sixty-three, made from the stems of a crinoid fossil quite common in the adjoining limestone, lay as left on a string. Others were made from a shell now found in the

Republican river; others were from the hollow bones of a small bird, and one large one was of limestone and was probably worn singly around the neck. The pipe was made of soft limestone. There were eleven arrow-heads, nine of which were of very nice workmanship and each about an inch in length.

"Other mounds are seen in that vicinity, which I am authorized to open at the expense of the Academy of Science.

"In some dozen places in Riley county fragments of Mound Builder' pottery are found, with stone implements, indicating that temporary villages had existed. Near Stockdale these marks are common. A vessel, holding about five pints, was dug up in Manhattan 1,500 feet away from the river, and nine feet below the surface."

The evening lecture was delivered by Prof. Canfield, of the State University, whose interesting presentation of "The Relations of the State to Higher Education" demanded and received the undivided attention of the large audience to the close.

The following resolution was adopted:

Resolved, That a committee be appointed to investigate all the reported new discoveries of coal in Kansas, to furnish a list of all Kansas coal mines and their localities, the thickness of the vein, the nature of the product and its value as fuel, and report thereon at the next annual meeting.

This committee consists of Messrs. R. J. Brown, G. E. Patrick and F. E. Stimpson.

The officers of the year just closed were unanimously elected for another term, as follows:

President—Professor B. F. Mudge, Manhattan.

Vice Presidents—Professor J. H. Carruth and Joseph Savage, Lawrence.

Treasurer—R. J. Brown, Leavenworth.

Secretary—Professor E. A. Popenoe, Manhattan.

Board of Curators—Professors F. H. Snow, B. F. Mudge, E. A. Popenoe.

CHEMISTRY.

THE KANSAS CITY CANDY FACTORY DISASTER.

BY THE EDITOR.

The circumstances attending the destruction of the candy and cracker factory of J. F. Corle & Son, in this city, on Friday, November 7th, give rise to opposing opinions regarding the origin of the terrible accident which resulted in the total destruction of three large brick buildings (Nos. 202, 204 and 206 Main street), with all the valuable machinery and goods therein, and, what is far worse, the loss of six human lives.

Two of the buildings (Nos 204 and 206), were originally ordinary business houses, twenty feet front by about ninety feet deep, and the other was constructed for a bank; all three stories high and constructed ordinarily well. These buildings were occupied by Messrs. Corle & Son for nearly two years, and had been to some extent reconstructed, though in no respect weakened by alterations, except so far as cutting two doorways through each long partition wall would tend to that end. During the first year there were several tons of heavy machinery, such as spice, coffee and mustard mills, in operation upon the second and third floors of these buildings, whose action jarred the buildings very perceptibly. Some months previous to the accident all of this machinery had been removed to the ground floor, and at the time of its occurrence both the second and third floors were only occupied as work rooms for the employees engaged in making crackers and candy.

In the confectionery room, which occupied the third story, there was a furnace for boiling candy and a number of benches at which the candy makers worked. The process of making certain classes of fancy candies is to mold them as iron founders mold cast iron, and trays of fine starch are used as molding flasks, i. e., the patterns are impressed in the starch and the boiling hot candy poured into them from large ladles, the foreman passing along the benches and pouring it into mold after mold as rapidly as they are emptied of the candy, after it is "set." After each operation of this kind the trays are "struck" or leveled off, and the patterns again impressed in the starch and the other steps repeated, with the necessary result of heating the starch more and more, and thus rendering it lighter and more ready to fly into the air with each "striking." Being utterly unirritating to the air passages, the employees could unsuspectingly breathe this powdered starch long after any other almost equally abundant substance floating in the air of the room would have become intolerable. This highly carbonized material having accumulated to an unusual degree, if a volume of *flame*, such as would arise from the rapid burning of a quantity of sugar overflowing upon the heated furnace, were suddenly communicated to the atmosphere of a closed apartment, so filled with its minute inflammable particles, an explosion must inevitably follow. The force of such an explosion would of course depend upon the quantity of the material burned, the rapidity with which it burns and the degree of resistance offered by the walls of the building to the sudden liberation of the expansive gases formed by the combustive process.

There is no question of the possibility of an explosion under such circumstances, and the occurrence of the terrible disasters in the candy factory of Greenfield & Co., about two years since, and in the flouring mills at Minneapolis in May, 1878, was almost unhesitatingly attributed by all investigators to just such causes as are suggested above.

Professor Peckham, of the University of Minnesota, says, "Professor Peck and myself agreed in the conclusion that the mills (at Minneapolis,) exploded from the ignition of a mixture of wheat dust and air. The testimony only established these convictions, and the experimental and theoretical proof placed them beyond

doubt or question. It appears to me that no other conclusion is possible when the question is discussed upon scientific principles, and that all the talk about 'distilling flour,' 'hydrogen' and 'mystery' is superlative nonsense."

From the testimony before the coroner in the Corle disaster, given below, it is very clear that an explosion occurred in the candy room from the ignition of starch particles filling it, which raised the roof, threw out the front wall, and shattered the partition walls between Nos. 202 and 204, and between Nos, 204 and 206, so that the whole mass of material fell upon the furnaces and was at once set on fire, giving such a start to the conflagration that before the firemen reached the spot everything was enveloped in flames.

W. C. Grimes testified that his place of business is No. 209 Main street, and that when the disaster occurred he was standing on a pile of lumber on the sidewalk directly opposite the buildings numbered 204 and 206, and had a full view of what occurred. He was looking up at the third story windows, saw a bright flash and heard a dull sound as if an explosion had occurred; in fact, felt assured that such was the case. Immediately following this he observed the roof of Nos. 204 and 206 rise up at least two and a half feet at a point over the partition wall. Then the front wall began giving way at the top, and was quickly followed by the crumbling of the entire wall. In his opinion the explosion caused the wall to fall. He had been in the building a number of times. There was no heavy weight upon the upper floors. He did not believe the cutting of the doorways had weakened the partition wall, as it was standing after the front wall fell, and was only crushed by the rafters and timbers from above. He saw the elevator three feet above the third floor when the front wall fell.

Frederick Pfau stated he had been employed in the candy department as foreman, on third floor of No. 204. The falling occurred a little after one o'clock; he had set a kettle of sugar on the fire; first sensation he felt, was a sizzing sound, a hot explosion, and his face, hair and whiskers were singed. The sugar must have run over, got on fire, then exploded, and burned his face. Then the roof began to come down. In his opinion the explosion was caused by starch. Have been working in big candy factories since 1849. In Greenfield's, New York, there was an explosion similar to that of Friday. Powdered starch will explode. There were two barrels of starch near the kettle and on starch boards; did not have a thousand pounds on the floor. There were about nine people on the third floor.

John Woerner testified that he had had twenty-five year's experience in the manufacture of candy, and was employed in the rear of the third story of No. 204. He had seen a kettle of sugar placed on the fire. Saw the kettle boil over and take fire, after which there was an explosion; the walls began to give way and he made his escape by a rear stairway. He stated that he had often witnessed the explosion of starch, but never with such disastrous results. There were about two barrels of starch on the third floor, in various forms.

Eugene R. Corle, son of the proprietor, employed at the factory, had just arrived from dinner when the disaster occurred. Was on the sidewalk in front of

No. 204, and heard a puff, like an explosion. Everything came at once, and the horses ran away. He considered the building and wall entirely safe. Had got clear across the street when front wall fell; heard roof fall first. The weight on third floors of No. 204 would not exceed a ton. There had been ten tons weight on second and third floor of No. 204. There was very little weight in upper floors of No. 206.

James A. McCleary stated that his firm had done considerable brick work around the building. He considered the walls perfectly safe. He had examined them with a view of erecting a fourth story thereon, and pronounced them sufficiently strong for the purpose. In his opinion an explosion would cause the walls to fall as had been described.

W. H. Barnes, employed as general carpenter about the building, was in the box department, an independent brick structure at the rear, when the disaster occurred. He had done considerable work about the walls and considered them perfectly safe. Had cut the lintels for the new door-ways, after which he was called to attend other duties. The openings had been completed and the mortar laid. He did not hear an explosion and saw no fire for three minutes after the walls fell. Did not consider the walls weakened by the openings. In his opinion, an expiosion of starch was the cause of the disaster.

George E. Sartwell, engaged as teamster at the factory, had his team backed up against the sidewalk, and was loading goods into the wagon, from No. 204, when he heard a faint noise in the upper portion of the building, looking up, saw the wall falling, his team started, and he turned his attention to them, getting on the opposite side of the street. There were several crashes. He saw the partition wall of Nos. 204 and 206 standing after the front wall was even with the ground. Could not state what caused the wall to fall.

Edward I. Hogan, a resident of Chicago, had visited the city for the purpose of examining some of the machinery in No. 208; had completed his inspection and was about to proceed to the office, No. 202, to see Mr. Corle, when he heard a crash, and thought something had fallen down the elevator. This was followed by a louder crash, and simultaneously with the falling of the walls flames burst out in all parts of the building.

Thomas S. Reyburn, of the firm of Welch, McCleary & Reyburn, brick contractors, had done considerable brick work about the building, and related the care taken in making alterations, building ovens, roasting furnaces, etc. He considered the builing suitable for the erection of a fourth story. The partition wall was perfectly safe but he did not like the appearance of the front wall.

James R. Wasson, testified that he worked with Corle two and a half years, lately as Superintendent of box department and machinery. Was on the second floor of an independent building at the time of the disaster. He did not think the flaw in the front wall had anything to do with the falling, and described the flaw to consist of a small crack, and pieces of plaster dropped out; considered the partition wall a good one, sound in every particular, The building had not

been weakened by cutting the wall; heard no explosion or falling of walls; attention was attracted by a boy calling, and ran down stairs and put out a bale of excelsior which was on fire; knew nothing else respecting the building.

John H. Haney was employed at the manufactory as carpenter for seven weeks Was working when fire took place, in third story of No. 206. Had wall completed about 11 o'clock this morning. Had been employed two days making changes in the door. There was no talk of any danger in making change. Had observed wall settling previous to cutting door out in the side of wall. Remarked slight settling in front walls of Nos. 204 and 206. Did not create any alarm in his mind. After dinner he resumed work for about thirty minutes. Heard a kind of rumbling noise on third floor. He was then on the first floor. Looked up and remarked, "What's that?" when building began to fall. It would seem third floor fell first, then the second tier of joists fell immediately afterward. He was not positive as to cause of disaster, but knew the third floor fell first. He was of opinion that the cause of the falling was a settling in the front wall, caused by some explosion on third floor, causing the wall to fall out.

Andrew Scanlan, at the time of the disaster, was standing 150 feet away, but in full view of the buildings, and testified that the first sounds heard were as if caused by a runaway team drawing a heavy wagon. and on looking in the direction from whence the noise proceeded, observed the front walls of the building fall after which there was a great cloud of dust. He immediately hurried to the place to render assistence. It was some little time after the building fell that he heard the cry of fire or saw any flames. He heard no explosion, and did not see the roof raise, although having a full view of the building.

Charles J. Hucket, employed as engineer of the stationary engine moving all the machinery, recognized the deceased; he was on the elevator of third floor of 204 when the disaster occurred, about 1:30 heard a rattling of bricks, then falling, but no explosion; was twenty feet away; he believed the falling was caused by the giving away of the centre wall, caused by the weakening of the wall in cutting the opening for a door; was some six feet above the floor in full view of the kettle, but saw no explosion; the excelsior scattered on the floor caught fire; could see the furnace after wall fell, saw the flames but not before; there was a crack in the partition wall between Nos. 204 and 206; the doorway was twelve feet from front wall; while placing timbers when hole was made was apprehensive of danger, but had no fears after work was completed.

It will be seen from an analysis of the testimony that all the witnesses except Scanlan and Huckett attributed the disaster to an explosion, which threw down the walls and spread the fire through the ruins and combustible contents of the buildings. Precisely analogous to this was the case of the Washburn Mill and Elevator at Minneapolis. All observers agreed that at the instant of the explosion the mill was brilliantly lighted from basement to attic, the sound produced was a like dull, heavy blow, not communicated laterally to any great distance,

while, within less than two minutes from the time of the explosion, the elevator, 108 feet high, was wrapped in flames from top to bottom. The report is described by Prof. Peckham as "a noise that sounded as if something as heavy as a barrel of flour had been tipped over on the floor above." Others, nearer, heard, "in addition to this report, a sound which they described as a succession of sharp hisses, resembling the sound of burning gunpowder."

Just such a description is given of the Corle explosion by all of the above witnesses, while Pfau pointedly speaks of the "sizzling" sound,

Several mechanics testify that the walls of these buildings were in good condition; sufficiently so to bear the weight of another story, which Mr. Corle contemplated adding soon. To the suggestion that the walls had been shaken, and the bond of the mortar broken by the jarring of the machinery recently removed, it is answered that when the openings were made in the walls for doorways, the brick-work was found so solid as to require the use of a crow-bar to pierce it, and the bricks came out in blocks or masses of several adhering firmly together. In fact, the circumstances of the case, as well as the testimony of the witnesses, seem to indicate that an explosion was the primary cause of the accident.

Numerous experiments have been made to test the explosiveness of various organic substances, all of which resulted in showing, as I have remarked above, that any finely divided, carbonized material floating thickly in the air may be exploded by sudden ignition by a mass of flame.

Professor Peck, another member of the faculty of the University of Minnesota, instituted a series of experiments with wood dust, starch, powdered sugar, flour of wheat, buckwheat, oats, corn and rye, by which he proved conclusively just what I have stated, using only a gas burner, a few ounces of the powdered material and a pair of bellows. In one experiment he took a box having a capacity of two cubic feet, with the lid fitted to telescope into it, a small hole in one lower corner for the nozzle of the bellows and another in the opposite corner for the gas burner. Placing a little flour in the bottom, and dispersing it in every direction through the box by a blast of the bellows, an explosion was produced, which raised the lid with a heavy man standing upon it, high enough to allow of the escape of the burning gas. By another similar experiment he threw a small box, weighing six pounds, twenty feet into the air, consuming less than an ounce of flour. By another he bursted the box and threw the flames half-way across the stage.

Whether the Corle "horror" was caused by an explosion or not, it is very certain from what has been said here that the dust of such establishments as flouring mills, candy factories, coal mines, saw and planing mills, &c., is a most dangerous element, and that its thorough removal is of the first importance.

Cloth or wood impregnated with certain saline substances will not blaze. Borax, alum, and phosphate of soda or ammonia are recommended as most suitable for this purpose.

ARCHÆOLOGY.

THE AGE OF THE CLIFF DWELLERS.

Among the recent additions to the American Museum of Natural History are many casts of curious "cave houses," or cliff dwellings, discovered by the Hayden Geological Survey. These structures are of such evident antiquity that a new epoch is formed which carries the existence of man in this country to so remote a period that the "Mound Builder," of whom we know comparatively nothing, appears comparatively modern. Only these stony ruins remain to tell the story of a once powerful and semi-cultivated people.

The first discoveries of these houses were made by Mr. A. D. Wilson, of the Hayden survey, and a later special survey was detailed under Mr. W. H. Jackson, who returned with the first authentic reports. According to Mr. Ingersoll, most of the ruins are found around the edge of the desert tract formed by the triangulation of the streams Rio Mancos, La Plata and Rio San Juan. The San Juan and La Plata have a width of bottom land between their banks, but the Rio Mancos runs like a brooklet along its narrow path, shut in by walls thousands of feet high. On the terraces of the more open cañons are multitudes of picturesque ruins; in the bottom lands are the remains of towns. In the wilder cañons the houses are perched upon the face of the chasm. In an encampment 1,000 feet above the valley of the Rio Mancos are single houses in groups of two and three and villages, according to the width of the shelf which they occupy. They are so high that the naked eye can scarcely distinguish them as specks. There is no access to them from above on account of the rocks that project overhead, and no present way of reaching them from below, although doubling paths and footholes in the rocks show where the way was trodden of old by human feet.

The cliffs in some parts are limestone, but most frequently sandstone, with alternating strata of shales and clay. The softer layers are hollowed out, leaving caves, whose solid stone ledges serve as the floors and roofs of the cliff dwellings. A few houses have two stories, and one shows four stories, but generally they are not higher than a man's head. Division walls are built from the rear of the opening and running outward to the front of the cave, which is so neatly walled by masonry of the prevailing stone that the artificial work is scarcely noticeable by a casual observer. Upon the summits of the loftier battlements are placed at irregular intervals round stone towers. The curve of the aboriginal masonry is perfect.

As to the habits of these dwellers we know almost nothing. Near the ruin called Hovenweep Castle (the castle of the deserted valley) no bones or signs of graves have been found; only heaps of ashes are left, mingled with charred wood, which tell the story of cremation, and probably of fire worship. It is assumed

that the present Pueblo Indians are the descendants of these people, from the fact that their huts to-day resemble the ancient cave houses. The absence of implements of warfare, either completed or unfinished, gives rise to the opinion that they were a peaceful race. Near some of the cities thousands of flint arrow heads were found sticking in the cliff—all pointing toward the city—showing that some strong invader had attacked them.

According to Mr. Jackson, the most remarkable remains are those found in New Mexico, and some of the buildings equal any in the United States. if we except the Capitol. One of these (shown in the cast by Hayden), the "The Pueblo del Arroya," has wings 130 feet in length, and the western wall of the court is 268 feet. Facing the center of the court are three stories in height. Another, the "Pueblo Chettro Kettle," is 440 feet long and 250 feet wide, and presents the remains of four stories; the logs forming the second floor extend through the walls a distance of six feet, and probably at one time supported a balcony on the shady side of the house. Mr. Jackson estimates that in the wall running around three sides of the building, 925 feet in length and 40 feet in height, there were more than 2,000,000 pieces of stone for the outer surface of the outer wall alone. This surface multiplied by the stones of the opposite surface, and also by the stones of the interior and transverse lines of masonry, would give a total of 30,000,000 pieces in 315,000 cubic feet of wall. These millions of pieces had to be quarried and put into position; the timbers were brought from a great distance, and, considering the vastness of the work and the amount of labor and time that must have been expended, these buildings may well be compared with the most famous works of what is so wrongly called the old world.

Among the caves of the Rio de Chelley were found some of the most beautifully tinted arrow heads ever discovered; also, numbers of large earthen jars of oval design. In a large three-story house were found many implements of domestic use representing the stone age. Among them were large grindstones and hammers. The walls, says Mr. Ingersoll, were plastered with cement of stucco-like finish. That it was spread on the walls by human hands is evident from the marks of the pores of the skin to be found on the surface. Occasionally the whole imprint of the hand has been left. One woman's slender fingers are thus preserved for the people of the nineteenth century.

As to the date of these erections, but little can be determined at present. The Moqui towns are now in precisely the same state of preservation as they were when described by the invading Spaniards, nearly 400 years ago. Assuming the Moquis to be lineal descendants of the Cliff Dwellers, how vast a time the old canyon castles must have been deserted even when the Moquis have no knowledge of the grand homes of their ancestors! Regarding the age of the Pueblos, they were said by Coronado, at the time of the conquest, to look very old. Castenado records that the inhabitants told him that the Pueblos were older than the memory of 700 years. That these ruins were known to the Spanish invaders we have proof in the journal of Don Antonia de Olermin, written in 1681, where

mention is made that eighty leagues distant from their camp there were *Casas Grandas*. Gallatin speaks of them and ascribes them to the Aztecs.

Perhaps time and more extended research may reopen the history of these people, who have been swept away from their grand cities, leaving nothing but the stony walls of their houses to tell the tale of their pre-Columbian greatness; but this we know, that these and other tokens tell that in reality America is the old world, and that thousands of years ago races flourished here in a high state of barbaric cultivation.—*New York Evening Post.*

SCIENTIFIC MISCELLANY.

IMPORTANCE OF TREE PLANTING.

The following extract is from a lecture by Geo. May Powell, delivered at the Pennsylvania State Fair, held at Fairmount Park, Philadelphia, the present fall:

In respect to tree planting, we take the ground, most emphatically, that as the time and labor and money needed to transplant even a small tree will put one hundred tree seeds in the ground, the slogan of the forest creating campaign opening before the nation is, "Plant tree seed where the trees springing from them are to remain." Transplanting, however, has its place, and is not to be ignored. Recent yellow fever experiences prove the south to have millions of dollars worth of trade interests per week involved in the subject of public health. A family in good health, north or south, east or west, may earn $1000 a year net. Sickness in the same family may cause it to suffer a loss—first of the ability to earn that $1,000; second, of $1,000 in expenses incurred by sickness. Such a family has thus $2,000 a year involved in the health question. By parity of reasoning, the nation has untold millions every year wrapped up in the health budget. A forest leaf has tens of thousands of valves made on purpose to pump in the poisonous carbonic acid gas and other "enemies" in the air, and pump out life giving oxygen The trees are also the chief conservators of those thermal and hygroscopic conditions which determine not only the health of men but of domestic animals, also the health of fruit and grain bearing plants. In any one of these relations, forests and climate is a cash question of startling proportions. The human life and health involved is of course not susceptible of financial gauge. A man cannot tell how much he would give to have a dead darling given back to him again.

All this aside from loss of life or health, the value of which cannot be computed. Much of this would be modified or remedied by planting rows, or double, treble or quadruple rows of trees around farms and along roads. Thus a farmer might have a thousand trees where they would harm nothing. If they were nut and sugar bearing trees they would soon annually net him more than a thousand

sheep, and also add more than the cost to the cash value of the farm simply as a question of beautifying it.

He said, we need laws providing forest engineers and literature—fire proof buildings and protection from forest fires; reduction of taxes for those planting trees, so as to squarely meet proper prescribed rules, as certified by a competent forest engineer. There should be no exemption from taxes for foolish or for bogus tree planting. The Forest Council urges people to pay more attention to planting tree seeds where the trees springing from them are permanently to stand, than to transplanting. By this means the expenditure of a given amount of time and money will plant a hundred times as many trees as by transplanting. Steep hillsides especially need this treatment to preserve streams, and are of little value for other use.—*Kansas Farmer.*

NUTRITIVE VALUE OF FLOUR.

Wheat flour contains four classes of substances: 1, water; 2, mineral matter, such as the phosphates; 3, nitrogenous substances, albumen, gluten, etc., which are all classed together as *albuminods;* 4, starch, dextrin, oil, etc., which are all classed together as *carbohydrates.* With the exception of water, these are all of value as food; the less water a flour contains the more valuable is the flour, because we can get water in a cheaper form than by buying it in flour. The albuminoids are valuable because from them we build up all the soft solids of the body except fat. The Germans very forcibly name this class *blutbauer*—blood-builder. While the albuminoids are especially concerned in building up and repairing the waste of the muscular and nervous tissues, they are the sole agents of nutrition. From hearing so much about the amount of albuminoids in flour, one might conclude that they alone are of value in this food material. If any one should come to such a conclusion, he should be fed on the leanest skim-milk cheese till he comes to his senses, for this "white-oak cheese" contains albuminoids in a very concentrated form. Experiments show that an animal will starve on pure albumen or fibrin. No animal can live on food entirely deprived of nitrogen, nor can he remain in health on food entirely deprived of carbo-hydrates. The due mixture of these two classes of food is what is needed for a perfect food, and this combination we find in flour, and this is one reason why wheat flour is so generally the food of all civilized men. Dr. Edward Smith has calculated that an adult laborer must consume on the average 214 grains of nitrogen and 4,831 grains of carbon in his daily food. If wheat flour contains 11 per cent. of albuminoids and 76 per cent. of carbohydrates, then 28 ounces of flour would contain almost exactly the quantity of nitrogen and carbon for this labor diet. If the flour contains less than 11 per cent. of albuminoids, we require the addition of some other substance rich in nitrogen, such as flesh, to form a perfect food. Dr. Letheby says: "The best variety of flour for bread is that which contains

less gluten than the preceding, as from 8 to 10 per cent. of it, instead of from 12 to 14 or 15. Dantzic flour and soft Spanish, as well as the American, called Genesee, are the best examples of it, and are highly esteemed by bakers on account of the fine quality of bread which is procurable from them, the richer varieties of hard glutinous wheat being used only to impart strength to weak and inferior descriptions of flour." It is not solely as a source of combined nitrogen in our food that the albuminoids in flour are desirable. We not only demand the presence of certain elements in our food, but that these materials shall be presented in certain physical conditions in order to secure their palatability and easy digestion. It is not enough, when presenting to a person a heavy sodden bread, to tell him that all the necessary food elements are present. He wants them in a form to gratify his taste, and to insure their rapid and easy assimilation in the process of digestion; he wants light bread, instead of a solid brick of baked dough. It is the peculiar relation of these albuminoids to light bread which renders them so important in bread making; and their physical properties are no less important than their chemical properties in any proper estimate of the value of flour.—*Prof. R. C. Kedzie.*

THE ESPIRITU SANTO.

Some time since my attention was called to a rare and beautiful flower in the possession of a popular florist of this city. This flower is known as the Espiritu Santo, or flower of the Holy Spirit. It is indigenous to the Isthmus of Panama, whence this specimen was brought. The flower is rare even in its native land. The stalk, which grows to a length of three and sometimes four feet, is surmounted by the buds and blossoms. The flower, which is not large, is of a delicate creamy white, and exhales a faint sweet perfume. One half of the flower is upright, the other, folded back, exposes a most dainty floral grotto, in which rests, as in a little cup-shaped nest, a tiny dove with outstretched neck and extended wings as if about to fly. The dove is of the same creamy white as the rest of the flower, with the exception of the upper extremities of the wings, which are beautifully speckled. The perfection and life-like appearance of the dove are incredible to persons who have not seen the flower.

In its native land the Espiritu Santo is held in religious veneration, and is supposed by the devout though ignorant natives to be a special emanation of the person in the Trinity whose emblem it bears. It is believed that if the flower be rudely plucked from the parent stem, or trampled under foot, the hand or foot which is the guilty agent of the deed will shortly wither and lose all life and power. If, on the contrary, it be plucked with a prayer, and for a good purpose, the hand that culls it will be shortly filled with treasure that must bring joy to the heart of its owner, being God-given. No wild beast has power to harm the fortunate possessor of a fresh and living blossom of this wonder-working plant, and of course it is equally efficacious in sickness.—J. C. BEARD, in *Harper's Magazine for November.*

SWEDISH SCHOOLS.

Gothenburg, Sweden, has a school system with some excellent and rather novel features. It is compulsory, and is entirely sustained out of the public fund. An end which is never lost sight of is that, when boys and girls are turned out into the world to assume the functions of citizens and to care for themselves, they shall not only have an elementary education, but shall be reasonably well skilled in some bread-earning occupation. Every school has a practice-shop where mechanical instruction is imparted by experienced master-workmen or mistresses, who are paid like ordinary teachers. Blacksmithing, shoemaking, book-binding, brush-making, carpentering, wood-turning, basket-making and carving are some of the trades which are taught. After being variously tested, a boy is thoroughly trained in the trade for which he has shown the greatest aptitude. In the practice-shops for girls they are instructed in industries suited to their sex. The proceeds of the pupils' work, which is sold, go far toward paying the expenses of the schools. It is inevitable that eventually similar facilities for industrial education must be incorporated with the American school system. We can not expect to escape the same popular necessities for this which have been developed in older countries. Sweden is by no means alone in adopting this expedient to prepare her youth to be immediate producers after leaving school. In Hungary, Germany and Scotland there are notable and well-established systems of this kind. An education is deficient, no matter how brilliant it may be, which does not fit its recipient to forthwith support himself from the hour that he bids farewell to his tutors.—*Globe Democrat.*

THE NEW WORLD POTTERY.

The specimens of American pottery, as they may be studied in such collections as those of the Smithsonian Institution at Washington and the Peabody Museum at Harvard, are divisible into great and easily distinguishable classes. There are, first, the water vessels and domestic utensils, such as jars and pots, which have been exhumed on the coast settlements. There are, secondly, the vases, many of which are decorated with human faces in relief, which come from Cuzco and Lake Titicata. A third division might be formed of vessels modeled after the human head, in some of which are preserved wonderfully fine types of the heads and faces that attracted the potter. Upon the first of these classes, the water vessels of the Chimus and inhabitants of the towns upon the coast, the greatest amount of ingenuity seems to have been lavished. They supply a comprehensive and curious index to Peruvian customs. The typical shape is a rotund jar with an arching hollow handle, and spout projecting upward from the middle of the arch. The handle and spout are of identically the same pattern in many cases where the body of the vessels is never seen twice alike. In devising the shape of the latter, the Peruvians followed a rule which is discovered in opera-

tion in every country with any claim to the possession of an original art. They found models in nature, and in the appliances and usages of their every day life. One of their jars thus represents a musician; another, a primitive boat; and where the double body is brought into requisition, or where a short neck takes the place of the syphon handle, a hundred instances are supplied of an appeal for suggestions to the familiar surroundings of the potter. Thus, in one case, the two sections of the body consist of a stag and a doe; in another, the orifice of one of twin bottles is occupied by a bird; in a third, one compartment is modeled after the human figure; in a fourth, the jar is single, and represents the human head and bust, the orifice being in the top of the head. A like rule was followed in designs graved in the paste, one being a rude and inartistic semblance of the human face, and another consisting of a bird. There are also painted representations of birds, serpents and double-headed snakes, and these are found mingled with geometrical designs, such as diamonds arranged in vertical bands and other patterns, which recall the early efforts of the Greeks, before their emancipation from Phœnician and Assyrian influences. The art of Peru, broadly speaking, may be said to have sought expression in three distinct forms, which are met with in the ceramic art of every country that passed the most primitive stage, namely, the imitation of natural objects by the modeler, who follows the actual form, and the same imitation by means of graved outlines and colored representations —*November Atlantic.*

IMPROVED TANNING PROCESS.

Dr. Chr. Heinzerling, of Frankfurt, a. M., Germany, has invented and patented a new and improved tanning process, which produces better and more durable leather, and is from twenty to twenty-five per cent less expensive than the old methods. The greatest advantage that it possesses over the old methods is that it requires but three to five days instead of as many months.

The raw hides are unhaired and swelled in the ordinary manner, and are then placed in a solution of sour bichromate of potassa, or sour chromate of soda, or sour chromate of magnesia and alum, or sulphate of alumina and salt. They remain in this solution for a few days, according to the thickness and quality of the hides and the concentration of the solution.

Instead of placing the hides directly in one of the above solutions, they can be first submitted to the action of a solution containing about ten per cent of alum and some small pieces of zinc. By the action of the alum and the zinc, amorphous alumina (clay) is deposited upon the fibers of the hide, and prevents an injurious action of the strong solutions. If the hides have been in the above solutions of soda or alum for a certain time, a few per cent of ferrocyanide or ferricyanide of potassa are added, which will prove to be very effective for the leather to be used for the uppers of shoes.

They are then placed in a solution of chloride of barium or acetate of lead,

or soap, for a few days, to fix the tanning substances. They are then dried and treated in the ordinary manner with fat, or paraffine, or naphtha, dissolved in benzine and similar substances, to which a small quantity of thymol or carbolic acid should be added.—*Deutsche Industrie Zeitung.*

THE ORIGIN OF WHEAT IN AMERICA.

Some time ago we published in these columns the commonly received statements in regard to the introduction of wheat into America from Europe, but if the fact stated below be true, then wheat must have grown in America long before the advent of the Spanish, English or Dutch to this country, or even of the Norsemen. It is generally supposed that Cortez planted in Mexico, in 1530, the first wheat ever grown on American soil. From Mexico wheat was introduced into Peru. The English and Dutch brought it to the present limits of the United States at the time of their first settlements here—1607, 1614 and 1620. Now, however, the story is brought forward that wheat was known to the Mound Builders, who inhabited this country heaven only knows how many centuries ago, but certainly no later than the year 1000 A D. As our readers are aware, these aborigines have left traces of their occupation all over our country, especially in the Mississippi Valley.

In a mound opened in Utah, were found buried the remains of a man six and a half feet in length, the skeleton of a woman nearly as long, and, moreover, handfuls of wheat preserved in a stone box. If this discovery was really made, and we are assured that it was, the supposition that wheat was unknown in America before the coming of Europeans is erroneous. It has commonly been supposed that the only cereal known to the Mound Builders was our maize or Indian corn.—*American Miller.*

WHY WE BUTTER OUR BREAD.

The layers of the wheat berry, as we proceed toward its center, become more and more completely starchy, and at the center but little else is found, and this portion makes our finest flour. The finer the flour, the less fit it is for nutrition. In its natural state, the wheat, with all its componets present, is not fully fitted for perfect human development There is deficiency in the potential heat producing materials, especially for cooler climates, there being only two per cent of fat in wheat. We instinctively supply this deficiency by the addition of fatty bodies. We spread butter upon bread, we mingle lard or butter with our biscuit or cake, and the fat meat and bread are taken alternately or coincidentally. The starch being a carbonhydrate, can afford, comparatively, but little heat in consumption, and the fats are demanded by the wants of the system.

Malleable bronze is made by alloying thirty-eight parts of copper with twenty-five parts of zinc, the copper being loosely covered with the zinc in the crucible. When the zinc has been fully incorporated with the copper, the alloy is cast in molding sand in the shape of bars, which are said to be capable of being hammered into any shape when hot.

Nonnus, the Egyptian, thus sang of the contrasts presented by the fertile fields and crowded port of Tyre:

"The ploughman draws his furrow
Beside the sounding shore;
The sailor's galley leaves behind
The foam of many an oar;
The Dryads of the mountain range,
Where the tall cedar waves,
Hear the Nereids, calling sweet,
Rising from ocean caves;
And the cool wind from Lebanon
Fans the tired laborer's brow,
Then swells the purple sails above
The trireme's rushing prow."

Others in ancient song compared her white walls and symmetrical towers to "a virgin bathing in the sea," "a galley of Tartessus swimming in mid-ocean," while a third described her as "an island on shore, and a city in the sea."

Mr. Peter Cooper, of New York City, has recently patented an improvement in the propulsion of railway cars, which consists in a combination of the well-known mechanical powers by which trains of cars can be propelled at any desired speed by means of an endless chain or wire rope.

Paper is now substituted for wood in Germany in the manufacture of lead-pencils. It is steeped in an adhesive liquid, and rolled round the core of lead to the required thickness. After drying, it is colored, and resembles an ordinary cedar pencil. The pencils sell in London to retailers at about 65 cents a gross.

BOOK NOTICES.

THE LIBRARY ATLAS. Imperial octavo; one hundred maps. Geo. P. Putnam's Sons; 1879; $10.

This work, which is the most complete and comprehensive we have ever seen of the kind, is an innovation upon the traditional, cumbrous old folio, as inconvenient as the Englishman's turkey, which was a "a bird too big for one man and

not enough for two." In this we have an octavo volume that one can hold in his hands or lay on his table without removing everything else, and can even put it away in his book-case with his other books, an unheard of luxury in atlases hitherto. Aside from this advantage, which is no small one, it is an admirable piece of work in every way—engraving, printing, mounting and binding. Every workman who has touched it seems to have been an artist in his line and to have done his best work on this book.

But, good as the mechanical work is, it has been fully equaled by that of Doctors Boyce, Collier and Schmitz, in their respective treatises on Modern Geography, Historical Geography, and Classical Geography, which make up the first two hundred pages of the book and are devoted to careful and accurate descriptions of the countries of the world from each author's standpoint.

The maps are perfection itself in their details, and number one hundred and two, including two charts of the planetary system, mostly double paged, and illustrative of the texts as classified above, and modified to keep abreast of the latest discoverics in both arctic and equatorial regions.

For a library, whether private or public, and as a book of reference on all geographical subjects, it may be regarded as a *sine qua non.*

THE NATURAL HISTORY OF THE ANCIENTS. By Rev. W. Houghton, M. A. Crown octavo, pp. 240. Cassel, Petter, Galpin & Co., New York; 1879; $1.75.

In these "Gleanings" the author has gone into the fields of ancient Egypt, Assyria, Palestine, Greece and Rome, beginning with the dawn of history and coming down to the time of Christ and the Apostles. He has worked with untiring industry among all ordinary and extraordinary sources for the information he imparts, and has succeeded in bringing together hosts of facts on natural history from widely diverse sources, which make up a most interesting and attractive book. It is a "new departure" in the literature of the day, and will doubtless meet with abundant success.

CHATTERBOX. Edited by J. Erskine Clarke, A. M. Royal octavo, pp. 420. Estes & Lauriat, Boston. For sale by M. H. Dickinson; $1.25.

The children must be amused and instructed as well as grown folks, and if there is one book in these days of beautiful juvenile publications that will suit a six-year-old better than another, it is "Chatterbox," with its vivacious, instructive and harmless stories and copious collection of fine pictures. We do not see why the children don't "cry for it" until they get it; but they won't cry afterward—for awhile, at all events.

EDITORIAL NOTES.

THE first lecture of the extra winter course before the Kansas City Academy of Science was delivered on the evening of November 13, to a full house, by Prof. F. H. Snow, of the Kansas University. His subject was Meteors, which was treated in a most interesting and comprehensive manner. The Academy is indebted to Prof. Snow for opening the course in a highly satisfactory manner; almost, in fact, insuring its success.

Prof. G. C. Swallow. of the Missouri State University, will deliver the second lecture of the course, on the evening of December 16, at Rev. C. C. Kimball's church, on Wyandotte street, near Ninth; subject, "Creation and Evolution." Season tickets for the course may be had from any member of the academy for $1.25. The remainder of the course is as follows:

December 16, Prof. G. C. Swallow, University of Missouri—Creation and Evolution.

January 13, Prof. J. T. Lovewell, Washburn College—Subterranean Drainage.

February 17, Prof. F. E. Nipher, Washington University—Choice and Chance.

March 16, Prof. B. F. Mudge, Yale College--The Drift Period.

April 13, Prest. S. S. Laws, University of Missouri—Subject to be announced.

May 19, Rev. Dr. Richard Cordley, Emporia, Kansas—Patience in Culture and Investigation.

The Academy has also secured Prof. R. A. Proctor, F.R.S., the celebrated English astronomer, for one or more lectures in the month of March, 1880. Date and price of tickets will be announced in due time.

THE wind storm of November 14 seems to have been quite extensive through the States of Illinois, Ohio, Indiana and Kentucky, amounting in some instances to a regular tornado. Troy, Hamilton, Marietta, Zanesville, and other points in Ohio; Cairo and other places in southern Illinois; South Bend, Paoli, Richmond and Hagerstown, Indiana, and Louisville and Paducah, Kentucky, were visited and much damage done.

A NEWLY invented locomotive in England is expected to at once supersede the employment of horses upon street railways in that country. It has been thoroughly tested and emits neither smoke nor steam. Its speed is from six to seven miles an hour, and its motion is practically noiseless. Thus it fulfills every condition which can be reasonably required by the public for a street engine.

THE pamphlet on The Quantrell Raid upon Lawrence, by Mr. John C. Shea, of the *Evening Mail*, will be read with renewed interest by those of our readers who had personal knowledge of it at the time, and with horror and amazement by those who were living at a distance and knew nothing of the intense malignity and fierce vindictiveness of the Border warfare of 1861 to 1865. It is carefully and truthfully written, and is well worthy of preservation as a typical chapter of the history of those bloody times.

DR. A. H. THOMPSON, of Topeka, Kansas, writes very pleasantly as follows: "We in Kansas feel a great interest in the REVIEW, and rather claim a share in the proprietorship, not being willing to consider it altogether a Missouri growth. We like it very much and wish it every success."

PATRONS of the REVIEW should remember that they can save money in subscribing for any of the magazines, either scientific or literary, of this country or England, by remitting through this office.

WE shall reserve our Comments on the Periodicals until next month, when we expect to give an extended notice of all of our exchanges, including any new features promised for 1880.

THE bewildering assortment of Christmas goods at M. H. Dickinson's this year surpasses all his previous efforts. The most artistically illustrated, printed and bound books; the most complex and complete scientific apparatus; the most elegant stationery, illuminated Christmas cards (single, double and quadruple), iridescent glass articles of all kinds, opera glasses by the most renowned opticians, etc., etc.

COLORADO, Arizona and New Mexico are, without doubt, the field of the future in mining enterprise. Utah, Montana, and other far northern Territories and States will continue to develop remarkably in respect to mineral resources, and their annual contributions to the national product of gold and silver may be expected to be increasingly large. But we may safely assume that the other three States and Territories named will bear off the palm for productiveness in the precious metals; to which may also be added copper and lead. They are comparatively virgin. Scientific mining is, within these limits, yet to astonish the world with its results.

THE steamer Faraday completed, on the 18th November, the laying of another Atlantic cable; this time between this country and France.

THE report of Horatio C. Burchard, Director of the Mint, was submitted to the Secretary of the Treasury on the 15th November, and shows the operations of the United States Mints and assay offices during the fiscal year ending June 30, 1879. During the year the total deposits of gold and silver, including silver purchases, amounted to $71,179,654, of which $42,254,156 were gold, and $28,925,497 silver. Of the above amounts $38,549,705 of gold and $26,934,728 of silver were of domestic production; $189,083 of gold and $1,060,779 of silver were United States coin. Silver coinage has been almost exclusively of standard silver dollars of which $27,227,500 were coined during the year, and the total coinage to November 1, 1879, has been $45,206,200. The total amount of subsidiary coin issued since the passage of the Resumption Act was $43,974,931.

THE ill-fated St. Charles Bridge was completed in 1871 by the Baltimore Bridge Company, under supervision of C. Shaler Smith, one of the most skillful civil engineers in the country. The structure has always been regarded as one of the stanchest on the line of the road, and no suspicion as to its giving way in such a sudden manner was entertained by any one. The spans on the sides are 312 feet in length, and the middle span 325 feet. At the present stage of water the bridge rests 80 feet above the river, and about 90 feet from the bed of the river. From this some idea may be gleaned of the distance the cars fell. The total length of the bridge proper is between 950 and 1,000 feet. The approaches stretch the entire length of the structure to 7,000 feet, or one and a quarter miles. The question of the "fatigue of metals" is one which in this and similar connections deserves the close investigation of engineers.

THE question of a Public Library is now agitating the intelligent people of this city. The only possibility of disagreement is upon the point of how and where to begin. The Public School Library has already about 2000 volumes, and we think there should be no hesitation in making it the foundation upon which to build, and it only needs the usual unanimity and concentration of effort which characterizes our citizens in all public enterprises to make it a signal success.

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PHILOSOPHY.

MAN AND EVOLUTION.

BY THE LATE PROF. B. F. MUDGE.

EMBRYOLOGY.

Let us take man as a single species of the animal world, and see if there is thing in his history or physical construction which justifies the conclusion that as been developed from the ape or any lower type. Here, in the beginning, re met with the claim that Embryology is entirely against us. While we admit on a hasty examination of that branch of natural history it appears to favor evolution, yet we think the claim in favor of development will not bear careful scrutiny. Evolutionists tell us that the human subject before birth passes through all stages of animal life, from the mollusk through the type of fish, reptile, bird, dog, and monkey, to man. Some have even given the exact stage and month * in which we were each one of these lower animals before birth.

Our answer to this is that, while the embryo may, at its very early stages, have some approach to an elementary form, it is in appearance only, and not in reality. That the future man is, from the starting point, a human being, is apparent from the fact that the traits of the father are constantly reappearing in the son from generation to generation. But if the offspring were ever fish, reptile or monkey, and developed during gestation into a man, it would be, when born, only human

* See preliminary table in Vestiges of the Natural History of Creation.

and never endowed with the personal traits of the father. The mother might give it a human form, but neither father nor mother could impress any personal traits upon the child. But we see, every day, in the color of the hair, contour of the face, the gait, and tone of the voice, the father reproduced in the son. We notice it at the first sight of the child or grandchild of an old acquaintance.

More than this, if we will go to the monuments and tombs of Egypt, we shall see, depicted on their walls, the faces of the oldest residents of Thebes and Memphis—the Copt, Bedouin, Fellah and Jew; and you can go among the inhabitants of that country to-day, and select the representatives of the portraits, 3,500 years old, and see the traits of fathers reproduced after more than a hundred generations. The Hebrew of old Egypt gives the same contour of face and physiognomy which his descendants exhibit in the cities of America, and this, too, when that race has been an inhabitant of all the various climates of the world. Could the personal minor traits have been preserved from father to son, if man had in that period been a hundred times a fish, reptile, dog, and monkey?

But we are not left without some facts to aid us on the question of Embryology. The spermatozoa of man and other male animals are so entirely different, in relation to size and shape, that we need not give diagrams to prove the fact.* Though exceedingly small, the sperm cells of our common animals not only differ from those of man, but they persistently differ, each from the other, in size and form. Yet these minute, microscopic spermatozoa of the father fix the future lineaments of the child, including its mental traits and tendency to inherit mental diseases.

The human ovum has not, for various reasons, been so carefully examined under the microscope as the sperm cell; consequently we cannot speak of its clear difference from the ova of other mammalia. The germinal spot in the ovum from which the embryo man is formed is, according to Gray, only from $\frac{1}{3600}$ to $\frac{1}{2400}$ of an inch long.

As we find the male sperm cell so much unlike that of all other mammalia, so we have a right to expect the female germ cell, if we could submit it to an equally high power of the microscope, would be equally human in its structure. When this shall be done, we believe as marked a difference will be found between human and animal ova as between the spermatozoa. This opinion is strengthened by the fact that the Graafian vesicle, or ovisac, which contains the ovum, varies in structure in different genera of mammals. It would be a great anomaly in nature if, while the male element and the Graafian vesicle are so distinct, the female germ cells should be alike in all mammalia. As its first segmentation after impregnation shows it to be a vertebrate, and not a mollusk nor crustacean, so almost the next change shows a difference from other vertebrates in its embryonic condition. Before the first month it can readily be distinguished from fish or reptile. By the twentieth day the segments which form the different portions of the head are developed, and by the end of the first month the human head is clearly defined.

* See Carpenter's Physiology, § 843, p. 750, plate I; Dalton's Physiology, p. 557; Morel's Human Histology, plate XXI.

The latter change deserves especial notice. The head, or cephalic, development is more prominent and clearly defined than other portions of the body. The brain cavity is large from the early portion of the second month. The brain matter is very albuminous and very human. The forehead is even larger than in the developed babe, and it is a well known fact that children at birth have relatively larger brains than mature men. Instead of requiring nine months to pass through the various stages from mollusk to monkey, it is, in less than one-fourth of the period of gestation, so well developed that the head cannot be mistaken for that of an ape.

At less than two months the difference in the sex can be detected, and at the close of the second month the toes, fingers, mouth and nose are clearly formed.* The heart, which during the first month is as simple as that of a reptile, does not long continue so. Carpenter says:

"A change in the type of the circulatory stystem of the fœtus, from that first presented by it, takes place at a very early period. At about the fourth week in the human embryo a septum begins to be formed in the ventricle, and at the eighth week it is complete. * * * During the same period a transformation occurs in the arrangement of the arterial trunks proceeding from the heart, which ends in their assumption of the form they present until the end of the fœtal life; and this undergoes but a slight alteration when the plan of the circulation is changed at the moment of the first inspiration." †

Thus before the human fœtus has passed through one-fourth of its period of gestation, it becomes distinctly human in sex, circulation and brain; and after that period, if not sooner, its resemblance to lower types of animal life exists only in imagination.

Fig. 13.

We give in Figure 13 the head of a fœtus "about the end of the second month," from Dalton.‡ It will be seen that, so far from a resemblance to a low vertebrate, it is superior to the highest ape. Instead of a resemblance to any of the lower types in its embryonic state, the "cephalization" || is almost an exaggeration. According to Dalton, the brain encephalon of the new-born infant exceeds that of the adult man in the proportion of 148 to 23, or relatively more than six times larger. If cephalization § is a standard of rank, as all our best scientists agree, surely the human infant, either before or after birth, is in no sense typical of a low form.

We are aware that there are some scientists of high reputation that have made

* Carpenter's Human Physiology, plate I.

† Human Physiology, § 895.

‡ Human Physiology, Fig. 245.

|| Cephalization—the brain and head structure compared with other parts of the body.

§ *Ibid*, p. 669, quoting Cruveilhier, Solly, Wilson, etc.

statements at variance from this. Packard says: "The human form is clearly indicated by the seventh week, the subsequent changes consisting in the remodeling of the outlines, in which it passes through a generalized ape-like figure, until the human form is shaped out." * Instead of an ape-like figure, we have from the first month a head which is far from that likeness. Let any one visit any well provided medical museum in one of our large cities, and he will find a set of embryo skeletons for each month. From them he will see that the head is not apelike, but the fully developed brain, in all stages, is clearly defined. In size and proportions it is most strikingly human, and the only objection is that the resemblance is to a type more intellectual than man. Nor is the figure in hands and feet related to the ape, but the fingers and toes are seen in the second month. This fact will be apparent by consulting any good illustrated work on midwifery or human physiology.† The limbs and fleshy portions of the early fœtus are also unlike the ape form.

Darwin gives us a figure ‡ from Ecker, of a human embryo ten lines long, having a clearly defined tail, which he compares with the embryo of a dog, relatively much farther advanced, having a similar tail. We have sought in vain in all our standard works on physiology for a similar form in a fœtal state, though the books abound in diagrams of the earliest shapes. We have also examined many fœtal embryos, some of even less size and in an earlier stage of gestation than Ecker's example, and never found one similar to it. Nor on inquiry of physicians of extensive practice, have we met with any who has seen such a form. Aside from the tail, the head and vertebræ are relatively more advanced than the arms and legs in specimens coming under my observation. It is true, that in the human embryo the coccyx, which represents the tail, is proportionally larger than in the adult, but, in all the cases we have examined, it lies under the skin as in the mature individual. Ecker's figure gives twenty-one clearly defined vertebræ (omitting the cervical) in process of development. We have never found the vertebræ so distinct in embryos twice as old. The first rudimentary back-bone is so indistinct and covered with flesh that it cannot be seen in an ordinary specimen at so early a stage. Even when the vertebræ are found, by dissection, as clearly as there delineated, the limbs, with fingers and toes, are distinctly outlined. But in Ecker's figure the legs and arms are only round, blunt knobs. From all these facts, we conclude that his example is not a normal one, but in reality an imperfect fœtal form. Either his, or all I have seen, are not ordinary specimens of fœtal development.

Commenting on this figure (and others where the head and neck are correctly represented), Darwin says: ||

"At this period the arteries run in arch-like branches, as if to carry the blood

* Life History of Animals, Including Man, p. 238.

† See Leisman's Midwifery, p. 181, fig. 78; Flint's Human Physiology, edition of 1876, plate III, fig. 1.

‡ Descent of Man, fig. 1, p. 15.

|| Descent of Man, p. 14.

to branchiæ which are not present in the higher vertebrata, though the slits on the sides of the neck still remain, marking their former positions."

These "slits" other evolutionists have frequently claimed as gill openings. They, however, are not slits or the marks of slits, but are, as Gray and others have plainly shown, the pharyngeal arches, which a little later become developed into jaws, hyoid bones and soft parts of the neck. No one has ever found the semblance of gills, and these so-called slits are clearly not connected with gills, lungs or with any breathing organ. On the other hand, the lungs of the human embryo, as soon as it has any definite shape, assume the mammilian form. Low reptiles, like the salamanders, have, as lungs, two long cylindrical sacks, extending nearly the entire length of the body. The higher type of reptiles, like the frog, have broader, flat lungs, but the position in the body and the arrangement of the cells and small air tubes are still quite reptilian. The lungs of the birds, the type next above the reptiles, are, as is well known, very peculiar, and line much of the interior of the body. But the position of the lungs in the human fœtus is, from its earliest stages, always in the chest, and they never assume the reptilian or bird form in shape or in the arrangement of their air passages. These various facts can be verified by any one who will dissect an aborted fœtus in its earliest stages, and compare its internal structure with the low animals which we have named. The little form, three-fourths of an inch long, has limbs that have not the least shape resembling the fin of a fish or wing of a bird.

The development of the embryonic heart, in like manner, does not pass, as it is asserted, through the fish and reptilian types. True, in the earliest stage it has but two cavities, irregular in shape, which might, by an effort of the imagination, be considered as similar in form to the double chambers of the heart of the fish. But these two imperfect chambers lie side by side as in the double heart of all mammals, while in the fish one lies in front of the other, as auricle and ventricle should. But, if we allow this stage to be fish-like, the next stage is not reptilian, as evolutionists have claimed; for the fœtal heart at its next stage has not the three chambers, one ventricle doing double duty to a pair of auricles, but two ventricles and two auricles, with the double circulation of a perfect organ of the high mammalian structure. This is complete at the second month of gestation, when, according to the author of the Vestiges of the Natural History of Creation, it is yet in its supposed fish stage. It must, however, be clearly kept in mind that the circulation and purification of the blood in the embryo are not by the action of its own heart and lungs, but, up to the moment of birth, they are by the action of the heart and lungs of the mother, the current passing through the umbilical cord.

We shall be reminded, also, that man has some rudimentary, useless muscles and organs, some of which are useful in the lower animals. This certainly favors the development theory; but we think that more importance has been credited to the facts than they deserve.

The *appendix vermiformis*, so useless and sometimes so injurious in man, is

supposed to have been derived from an animal of a lower type. But as it is found in marsupials* and some of the monkeys, mammals most widely separate, and not in most of the intermediate types, and is always a useless organ, we cannot perceive that it has any bearing on this question.

The caudal muscles, so useful in animals with a tail, are found rudimentary in man. They are also found in nearly all of the tailless apes, and if derived from the lower orders of monkeys, why did not the development which shed the tail act harmoniously and drop the caudal muscles also, or at least shed them entirely before the ape could have made that much greater advancement and become a man?

In this connection it is well to recollect that a tail has little or no connection with the rank of an animal. Man has four caudal vertebræ, and many of the higher apes have the same number, and also the low, slender lemur (*loris*), while the Barbary ape (*Macacus Inuus*) has but three. On the other hand, the *Semnopithecus*, higher in rank than the *Macacus*, has thirty-one. The reader will readily recall many common animals with very short tails.

FOSSIL MEN.

A careful examination of man's geological history confirms us in the opinion that he always has been a man, and was not derived from a lower type. As the theory of the extreme antiquity of our race is recognized very generally by the scientific world, we shall assume that fact as settled.

Dana, our greatest American geologist, places man "at least as early as the alluvian part of the warm Champlain era, and probably earlier." † As the Champlain era preceded the Delta period, and also the period of the elevation of land over the high latitudes of North America, we can hardly place this, on the received principles of geology, at less than 200,000 years.‡ The question then arises, What has been the condition of man during this long lapse of years, judging from his fossil bones and the remains of his domestic implements?

When the doctrine of the antiquity of the human family was in its early stages, the celebrated Neanderthal skull was found, presenting a singularly low intellectual conformation. The flat, receding forehead, prominent superciliary ridges, and other traits, were so characteristic of a low intellectual condition that it was immediately claimed as evidence that the oldest fossilized races were far lower than those now existing. This, in fact, is now claimed by some popular writers on the side of evolution. But subsequent discoveries have not sustained this conclusion. Though the Neanderthal skull has more than twice the cubic capacity of the gorilla or any other ape, no other fossil human skull has been found of so low a type; but, on the other hand, the large numbers since discovered, many of them far older than this, compare favorably with the existing races. The skeleton of the Neanderthal specimen does not differ from the average skeleton of living men.

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* Huxley—Anatomy of Vertebrate Animals, p. 280.

† Manual, p. 576.

‡ See Kansas City REVIEW, August, 1879, p. 222.

The Borreby crania are the nearest in form and character to the Neanderthal, but Prof. Huxley states that there is a marked resemblance between them and the Australians.

On the other hand, the Engis skull, which is far older, probably twice as old as the Neanderthal, "approaches," in the language of Lyell, "near the highest, or Caucasian type." Huxley calls it a "fair average skull, which might have belonged to a philosopher, or might have contained the thoughtless brains of a savage." Dana says "the cranium was high and short, and of good Caucasian type, though of medium capacity."

The Calaveras head, from California, one of the very oldest, whose antiquity and authenticity are now so well established, though possessing some Indian traits, is nearly up to the average of the European. It was found 132 feet below the surface, under four beds of lava and in the fifth bed of gravel, alternately deposited in a gold mine. When first presented to the scientific world, its authenticity was doubted. Those who favored evolution objected to it because its structure was so near that of the skulls of the existing races. Not only has the average human cranium been preserved for so long a period, but many of the peculiarities of the typical Indian.

Prof. Whitney has quite recently presented some additional remains, between thirty and forty instances, from the same or similar beds, showing strong evidence that man is Pliocene. Then the Neanderthal skull is quite modern. Prof. Whitney adds, as one of his conclusions, "Man, thus far, is nothing but man, whether found in Plicene, Post-Pliocene, or Recent formations."

In 1875 there was exhumed near Worthing, England, the skeleton of a woman, which was presented and described by Prof. Rolleston at the meeting of the British Association.* It belonged to the earliest Neolithic age, and the skull had a cubic capacity of 105¾ inches, or about thirteen inches above the average of the European. The shape of the skull was of a good form, above a medium.

The oldest human remains known, excepting those of California, are probably those found at Mentone, near Nice, in 1872 and subsequently, and are of the Palæolithic age.† The best was in excellent preservation, and Rivière describes it as having "a rather long but large head, high and well made forehead, and very large facial angle—85°." Prof. Huxley gives a similar description.

It will thus be seen, from the few examples quoted, and which may be considered fair specimens of the whole, that fossil men differed as much among themselves as those now living, and at the same time were closely similar to the present races.

Broca, ‡ before the French Association, makes three races of pre-historic men, viz: Constadt, Cromagnon, and Furfooz. The names are derived from the three localities where the remains are found. The first, or oldest, he places in a

* See *Nature*, September 7, 1875, p. 419.

† *Nature*, September 7, 1875, p. 419.

‡ See a brief report in *Nature*, August 30, 1877.

low rank of intellect, but not lower than some now existing. This race is founded on a few bones, and, we believe, is represented by no entire skull. The Furfooz he also places in a low rank. But the intermediate, or Cromagnon race, he ranks as the highest, and says its crania are equal, if not superior, to the modern Parisian, or in type closely approaching the Caucasian. It will thus be seen that Broca does not find a regular grading upward from an oldest low intellect to the highest in the modern, but that the intermediate pre-historic race was nearest to the best living races. The earliest are not more degraded in intellect than some of the present tribes of the human family. The oldest remains of man in Europe, where the search has been the most untiring, differed about as much as, but no more, from each other than those now living.

Broca's account appears to coincide with the observations of Huxley, Lyell and others, in giving the most ancient races an intellectual condition very similar to, if not identical, with those of the present day.

The tools and implements of the most ancient men are of rough stone, showing a low civilization; but the structure of the head shows the ability, from the first races, to become civilized. Just as the first fossilized hogs, from the beds of the earliest Eocene, were typical hogs, so the earliest men were in brain and skeleton identical with those of to-day.

There is no peculiarity in the structure of the skeleton of the oldest human remains which is not found in existing races. Nor is the size shown to be greater. The best Mentone man is probably the largest fossil, with one exception, of the human race, and he was not over six feet in height. The close resemblance between the first and the living races is recognized by the ablest authorities who favor evolution.

Wallace says: "The few remains yet known of pre-historic man, do not indicate any material diminution in the size of the brain case." *

Prof. Darwin says: "At the most ancient period of which we have as yet obtained any record, the races of man had already come to differ nearly or quite as much as they do at the present day." †

Huxley, after a long description of the oldest pre-historic skulls, says: "In no sense can the Neanderthal bones be regarded as the remains of a human being intermediate between man and the apes." He further adds: "The first traces of the primoidal stock whence man has proceeded, need no longer be sought by those who entertain the doctrine of progressive development, in the newest Tertiaries; but they may be looked for in an epoch more distant from the age of *Elephas primigenius* than that is from us." ‡

Lyell, too, who claims a greater antiquity for man than Dana, in his last work says: "Yet, in spite of the long lapse of prehistoric ages during which man must have flourished on the earth, *there is no proof of any perceptible change in his bodily structure.*" ||

* Limit of Natural Selection, p. 336.

† Descent of Man, Vol. II, p. 366, American Edition.

‡ Observations on Human Skulls from Engis and Neanderthal.

|| Antiquity of Man, p. 540. The italics are ours.

Can any anti-evolutionist use stronger language? If two hundred thousand years, or, perhaps, five hundred thousand years—seven thousand or fifteen thousand generations—have not made "any perceptible change in his bodily structure," how long will it take to develop him from a reptile or from an ape?

If we follow others, as Abbott and Shaler, Tiddeman, Geikie, Pengelly, Ramsey, etc., in assigning man to an inter-glacial age, or Prof. Marsh, Whitney and others, that he may be from the Pliocene, the argument is still stronger in our favor; for, according to the authorities cited, no form intermediate between man and the apes has been found, and the structure of our race has been always the same. The farther back we accept the antiquity of the human family, either in geological deposits or in years, the more forcibly becomes the fact, that time and environment cannot have developed man from a low animal.

EVOLUTION AND CREATION.

BY GEORGE C. SWALLOW, M. D., LL. D., PROFESSOR OF AGRICULTURE AND OF NATURAL HISTORY, UNIVERSITY OF MISSOURI.

Three hundred and eighty-six years ago the third day of last August, there was a grand gala day at Palos in Spain. By the wishes of the good Queen Isabella, the courts of Castile and Arragon and the dignitaries of the Catholic Church, were assembled in that goodly city to pronounce a benediction upon Columbus and his three small ships, which that day sailed from this renowned port. These poor pinnaces, unseaworthy, badly manned and poorly equipped, turned their prows boldly out into the Atlantic, and for seventy-one days held their way into the vast expanse toward the setting sun, in search of the rich Cathay. As day after day passed by and favoring winds and currents bore them on into the vast unknown, a superstitious fear settled down like a pall upon the ignorant sailors. They believed the earth a broad expanse, bounded by precipitous edges. They saw in their fears the trade winds and the equatorial currents bearing them steadily on to the fatal verge, over which they would plunge down and down, into the fathomless abyss below.

But Columbus believed the earth a globe, and that he would find the east *under the setting sun!* The fearful sailors counseled a return before it would be forever too late. Columbus, with sublime faith in God and science, held a steady helm, and kept his course. The sailors plotted mutiny and threatened violence; but the intrepid leader kept his undeviating way, and on the morning of the twelfth day of October, planted the banner of Spain and the Church on San Salvador.

Thus ended the first great conflict between modern science and the church. The church taught that the earth is a *broad expanse* of land and water; but the dawnings of science declared it a *globe.* Columbus believed the science and conceived the idea of reaching China and the Indies by the west. He spent ten

years in trying to persuade the monarchs of western Europe to furnish means for the voyage. But their Catholic majesties disbelieved his science and doubted his ability to solve the geographical paradox of finding the *east in the west.*

But the good Queen Isabella gave him the ships and the doubting prayers of the church for his success and safe return.

His *failure* to find *China* became a grand success in finding *America.* It was a splendid triumph for both science and the church; as it gave a new continent to the church for its victories, and to science for its wonderful discoveries.

This conflict involved no important religious truth; but there is another conflict between some scientists and the church now waged with unparalleled ability and zeal all over the civilized world. In it are involved some of the vital truths of the Christian religion, and indeed, of all religions. It involves no less a question than the origin of man—whether he descended from a created Adam, or whether he must trace his ancestry back through a countless series of animals to an infinitesimal speck of self evolved sarcode.

The one is the teaching of the Bible, the other is the theory of Evolution. The one is the teaching of God's word; the other claims to be the indication of God's works. But the word and the works of the Creator must agree. If they do not agree both in appearance and reality, it is because we do not interpret the one or the other aright.

Some appear to think that this disagreement between some scientists and theologians is fatal to both science and religion; but they should remember that the expounders of natural laws and christian teachers are alike fallible men; that they often do make mistakes in their expositions of natural and revealed truths. We might illustrate our ignorance:

An ocean steamer is a little world in itself. The owner provides the power for running the steamer and all things needful for the comfort and safety of the passengers. Two philosophic flies happen on one of these steamers. They determine to investigate its nature and its laws. One fly goes down into the engine room and finds the water hot and vapory. The other fly investigates the dining table and finds the water cold and icy. There comes a grand conclave of the fly people; and the two investigators, big with the magnitude of their discoveries, come from the antipodes of the ship world and report. One reports his discovery of *water as cold as ice*, which the people drink; and the other reports his discovery of *water as hot as fire*, which makes the steam to propel the ship.

The first, positive in the fullness of his knowledge, loftily condemns the discoveries of his fellow worker as rank heresy, fraught with the most fearful consequences to the whole race. For, said he, if we drink his boiling water it will kill us all. The other replies with equal zeal and assurance, that the teachings of his co-worker are mere superstitious dogmas, fit only for the ignorant and vulgar. For, if water were cold it would make no steam, the ship would stop in mid ocean and involve all in universal ruin.

The flies take sides. The *cold water flies* and the *hot water flies* wage a bitter

contest, until some observer sees the water poured into the tea kettle *cold* and come out *hot*, and reports the fact that water may be both cold and hot. This proves both parties right and both wrong—both right in the facts reported, and both wrong in the conclusions drawn from an imperfect knowledge of water.

Thus we might expect ignorant flies to differ about the nature and functions of the outfit of a steamer. No less should we expect ignorant men to differ about the moral and physical laws of the universe.

Some men seem to think a difference of opinion involves a criminal neglect of truth and duty; that scientists, who announce truths or theories apparently conflicting with the interpretations of revelation, are heretical and pestiferous, inimical to the cause of truth and Christianity. But it is a remarkable fact that a larger part of the scientists thus condemned as hostile to the church, have been its devoted members; and many of the facts so vigorously condemned have been accepted as true by the church itself. Among these may be mentioned the astronomical theories of Galileo and Copernicus, and the geological conclusions of Conybeare and Murchison as to the age of the earth.

The theories thus far condemned have done very little injury to science or religion. A difference of opinion among the flies, could scarcely retard the progress of an ocean steamer; so the theories of men will scarcely mar the progress of nature or the faith of men.

Tyndall's denial of the efficacy of prayer, has scarcely checked a Father's care or lessened the number of devout worshippers. Every christian must feel for him as for an orphan, who knows no father's listening ear. And every one can but pity a man whose sublime *impudence* permits him to tell the hundreds of milions who *know* their prayers are answered, that they are deceiving themselves and bearing false testimony to their fellow men.

So every scholarly christian must blush with shame when he hears our christian teachers confound the *creating* and *making* of the glorious *Mosaic cosmos*, or in any way violating the acknowledged teachings of science and revelation.

But "*Development*," which you invite me to discuss, is no matter of recent origin; nor did it come fully developed like Minerva, all armed from Jupiter's brain. It has come in fragments from the brains of sundry speculators along the ages of the last three thousand years. But it was left for modern scientists to weave the parts into that ingenious system called *Evolution* or *Development*.

A history of the origin and progress of the various parts would be instructive; but it would consume my hour. I can only glance at the origin of some of the most salient features.

Epicurus, so far as I know, gave the first distinct declaration of the *spontaneous generation of animals* from the dust of the earth. This Grecian philosopher taught that the primitive earth, rich and nitrous and warmed by the sun, was soon covered with plants and that animals sprang spontaneous from the fat soil.

About the middle of the last century, M. Maillet published a *philosophic romance*, in which he made the ocean the source of the lower orders of organic be-

ings; and when the land appeared in the primeval ocean, these lower forms of plants and animals came trooping up from the teeming seas to populate the inviting shores. Flying fish became birds, and creeping things four-footed beasts; and some imaginary monsters, mermaids perhaps, became men.

In this author, we have the distinct *transmutation* of *species* announced in a form but slightly more reasonable than that in the fable of Deucalion. The change of fish into birds is a little more plausible than that of stones into men.

At the beginning of the present century, M. Lamarck and other French savans reasserted the theory of development and the transmutation of the lower animals into the higher, until all were produced by natural laws, without a Creator to give the vital spark and inspire the moral and religious nature of man.

But toward the middle of this century, *The Vestiges of Creation* appeared in England. In this famous work the ingenious author combined the *Nebular Theory* of La Place, by which the *Heavenly bodies* were evolved out of the primeval *star dust;* the *spontaneous generation* of Epicurus, by which the world was peopled with plants and animals; and the *Evolution* of Maillet, by which simple animals, that sprang like mushrooms from the fat primal earth, were developed into higher and higher orders, until the monkey became the man.

And all these wonderful miracles, these suspensions and violations of laws are accomplished by the laws themselves—by the powers of matter inherent in the primordial star dust.

These remarkable departures from the usual standards of doctrine in both the scientific and religious worlds, were so great and startling as to attract universal attention and to awaken much solicitude for the stability of those opinions, upon which had been based the world's progress in letters, philosophy, science and religion. Mankind had believed there could be no beginning or change of existence without an adequate cause. And yet this hypothesis of Development asks us to believe in a nebulous matter or star-dust, which filled all space, condensed around certain centers, assumed a rotary motion, and from time to time threw off masses which became systems, planets and satellites; that our planet was pregnant with spontaneous life; that sea-weed covered all the shores with gaudy colors; that myriads of protozoans swarmed in all the waters, and countless polyps reared their coral cities in all the shallow seas; that when the first dry land appeared, the first of living things came swarming out upon the welcome shore and were transformed, as each most desired, into creeping things, the beasts of the field, the birds of the air, and even into man himself; and that all these wonderful creations and transformations came with no creative power and no power to rule, save what was inherent in the original star-dust.

But the *Vestiges* contained a formidable array of facts and fiction, science and philosoply, reason and sophistry, to sustain its strange theories. The discussions which this work called out, were exceedingly able and so fully sustained the old standards of thought and reason that scientific men continued to believe in the creation and immutability of species, and the church-men in the Creator and the Genesis of Moses.

Some ten years later Mr. Charles Darwin published *The Theory of Evolution*, somewhat modified. He adopts the idea of Oken, that the first and lowest forms of animals were created; and from these simple primary animals, mere jelly-specks, all the higher orders were developed by *natural selection* and the *survival of the fittest in the struggle for life.*

Mr. Darwin has collected a vast array of facts from all departments of nature to illustrate his hypothesis. He presents the facts and arguments with great fairness and ability. Still he does not appear to feel his theory proved, but that the facts which sustain it far outweigh those which condemn it.

Many, especially English and American scientists, who reject the theory of Lamarck and the Vestiges, accept it as modified by Mr. Darwin, admitting the creation of the primordial animals. But the French more generally reject it. It is a remarkable fact that many Darwinians not only accept the theory of their great leader, but also the entire unadulterated system of the Vestiges.

There are other singular facts in this connection. While the young zoölogists and botanists of America accept the theory in its extreme form, the older geologists reject it, while the advocates of the theory appeal to the vast cycles of the geological record for proof, the geologists themselves fail to find any real proof in that record; while Tyndall and Proctor, who know but little of plants and animals and geology, accept development, Agassiz and Dawson and Hall, the first of all naturalists, especially in the departments upon which this theory rests, wholly reject it.

Having stated this epitome of the history and present status of the Development Theory, I propose to examine very briefly some of the arguments by which it is sustained, and to present a few of the objections to it; and to do this from a purely scientific standpoint. It must be borne in mind that science accepts no theory as proved, until it is shown to be in perfect accord with all important known facts of science.

Whatever may be the opinion of Mr. Darwin or any other individual, the real question at issue in this whole discussion, according to Drs Bastian and Child, Prof. Haskell, Mr. Herbert Spencer and Mr. Huxley, is whether all organic beings, all plants and all animals have been produced by the laws of nature without any supernatural creative power.

In this are involved two distinct questions:

1st. Whence came the first plant and the first animal? Epicurus says by the spontaneous generation of the earth. Evolution also says, by spontaneous generation. But Moses says, by creation.

2d. Whence came the first plant and the first animal of each species? (There must have been a first dog and a first horse and a first man as well as a first of all animals.) Evolution says by natural selection and the survival of the fittest. But Moses says, by creation.

Let us examine what science says on the spontaneous generation of organic beings and the evolution of species, by reviewing the leading arguments adduced to prove these hypotheses.

SPONTANEOUS GENERATION.

Many who believe in the spontaneous generation of animals, have been experimenting for many years to prove the theory.

Some thirty years ago, one Dr. Crosse announced his success; that he had evolved new animals by passing a galvanic current through certain solutions. These minute beings were all alike and were named *Acarus Crossii*, in honor of their creator. But alas! for human hopes! Dr. Crosse exhibited his experiment; and the little mites came trooping up the wires from the productive solution. But an observer recognized them as old acquaintances. They were the well known little *spiders, Acarus horridus!* and Dr. Crosse was compelled to step down from the high throne of a creator to the very humble seat of a *hatcher of spider's eggs!*

Several other experimenters have supposed they had succeeded in this new line of creation; but careful investigation has clearly proved that they had merely warmed into life the germs of pre-existing organisms.

So far, then, as science speaks at all on this subject, it says there is no such thing as spontaneous generation of organic beings, and sustains Harvey, that all living things came from germs or eggs, the products of parental beings—"*Omne vivum ex ovo.*"

Since, then, science has settled this question of spontaneous generation against Epicurus, Lamarck, Crosse and their followers, it only remains to inquire how far science sustains the evolution of one species from another.

EVOLUTION.

Various arguments are advanced to prove that evolution is the source of the higher orders of animals and plants. These arguments claim our careful attention, as upon the issues depend many opinions which mankind have held as sacred as household gods.

I. BY HYBRIDISM OR THE PRODUCTION OF HYBRIDS.

It is claimed that hybrids, as the mule from the ass and the horse become distinct species; and that the higher orders were thus produced by natural laws only.

It is well established that mules or hybrids are sometimes produced in both the animal and vegetable kingdoms; and that hybrids are like both parents in some respects and unlike both in others. But there are very many serious objections to hybridism as a mode of developing new and higher species of animals.

1. There are few if any instances in which hybrids are capable of perpetuating themselves. All the skill and science of men, incited by the hope of boundless gain, aided by the resources of nations, have been exerted in vain to produce a fertile mule. Man has exhausted all his resources for these thousand years; he has brought to his aid all the relatives of the equine family—the zebra and quagga from the wilds of Africa and the hemionus from the steppes of Asia, to aid his grand work in producing a fertile equine hybrid. But all in vain. All the hy-

brids prove barren *inter se*. The integrity of species is sustained—the creative fiat stands vindicated.

2. The hybrid is sometimes fertile with one or both parent species; but in all such cases the progeny loses the characteristics of the hybrid and returns to one or the other of the original species, thus barring all hope of a new species from such hybrids.

3. In the vegetable kingdom, it is well established, though disputed by some, that hybrids may be fertile. But it is clearly shown that the progeny of the hybrid returns to one or the other of the parent species; as proved by the seedlings of the famous Bartram Oak, from which it was expected a new species would be established.

4. It is admitted by all that hybrids seldom occur in nature; that nearly all well established cases, have been produced in the domestic state and by conditions forced upon the parents by the power and art of man. Such is the want of sympathy between different species in the state of nature as to preclude the production of hybrids under all ordinary circumstances of natural animal life.

5. If the 500,000 species of animals have been produced by hybridizing a few of the primitive species, nearly or quite all of them must have been produced in a state of nature; since they are older than man or at least contemporary with him, and could not have been produced by his aid.

6. Hybrids partake of the nature of both parents. They are seldom higher or lower than the average of the two ancestral species. No hybrid has shown the characteristics of a higher species or order. If then it were even proved that hybrids form new and permanent species, the higher orders could not have been thus produced from the lower primordial species.

There are therefore no facts to show it even possible to produce a carnivorous hybrid from herbivorous parents, none to show even the remotest possibility of producing a human hybrid from any two species of monkeys.

It is claimed by many that the various races of dogs were produced by hybridizing two or more species of native dogs. If so, the experiment has been a long one and under man's best care. But it has produced nothing but dogs; and no one expects it ever will produce anything but dogs.

An English scientific exchange, dated November 20, contains a report from a British observatory concerning the November meteors. It seems that from the morning of the 12th to the 15th there was a total absence of moonlight and the sky was cloudless, affording the best possible conditions for accurate observations. A constant watch was maintained and the meteors discovered were more numerous than in either of the last few years. The total number viewed was 309. Eighty-six were of the first or second magnitude, and nine others were brighter than first magnitude stars. The largest number seen during a single hour was fifteen, from 4 to 5 a. m. of the 14th.

ARCHÆOLOGY.

A BURIED RACE IN KANSAS.*

BY JUDGE E. P. WEST.

LADIES AND GENTLEMEN:—I have the honor this evening, of presenting to the Academy a report of some eqxlorations in Archæology which I have recently made on its behalf in Kansas.

The object of the exploration was to determine whether our Missouri Chambered Mound Builders extended their domain westward along the Kansas river valley and valleys of other important streams in Kansas.

The investigation has been as thorough as the time at my disposal admitted of, and I think has been sufficiently so to settfe the question involved, definitely.

With the exception of the mounds at Fort Leavenworth, described by the Rev. Mr. McCoy, in his history of the "Masonary work among the Aboriginies in Kansas," and perhaps a few others along the Missouri river, defining the Eastern boundry of the State, it may be safely assumed that the Chambered Mound Builders had no permanent abode in Kansas, or if so, have left no enduring monuments as evidences of it. But we must not suppose that Kansas is entirely destitute of pre-historic remains similar to some of those found in Missouri.

On the farm of Mr. Geiesa, near a small creek of the same name, a few miles west of Lawrence, fragments of pottery and stone implements are found very similar to those found on McGee creek, in this county, and on Jersey creek, in Wyandotte county, Kansas, south of the Missouri river, and the circumstances under which they are found are very like. There can be but little doubt that these vestiges, and those of Jackson and Wyandotte counties are synchronous, and the work of the same race, but differing from the race whose skill in chamber bnilding is so conspicuous in the chambered mounds in Clay and Platte counties north of the Missouri river. By the kindness of Mrs. Apitz, of Lawrence, and Mr. Geiesa, I was enabled to visit the ground, and I picked up several specimens of broken pottery and some stone implements, which I have placed in the cabinet of the Academy. I have two specimens of very finely finished arrow-points, picked up by Mr. Geiesa at the same place, which he was so kind as to loan the Academy.

In the vicinity of Junction City in Davis county, several mounds or rather stone heaps are found, containing human remains. I was enabled to partly examine some of these near the farm of Mr. Davis, editor of the Junction City *Tribune*, and through the kindness of that gentleman. We picked up on one of the mounds several fragments of a skulll bone and some pottery of the true basket type, but, unfortunately for the great antiquity of the mounds we also picked up a piece of a copper kittle, associated with the other fragments. These, by

* A paper read before the Kansas City Academy of Science, Nov. 25, 1875.

permission of Mr. Davis, I have placed in the cabinet, as also a flint arrow-point attached to the shaft, showing the mode of attachment; which was presented by Mr. Davis to the Academy.

Dr. Seymour opened other mounds of the same character near Junction City, which were described by him in the January number of the KANSAS CITY REVIEW OF SCIENCE AND INDUSTRY, of the present year. He, too, found associated with human bones and stone implements, pieces of thin copper, no doubt the remains of a kettle such as are used by our trappers and modern Indians.

Similar mounds are found in many places through Kansas, Colorado, New Mexico and Arizona, and are no doubt traceable to modern Indians and our early mountain traders and trappers.

Dr. Seymour was kind enough to point out some earth works, overlooking the Republican river, just outside the northern limits of Junction City, which were described by him some years back in the local papers. There can be no doubt but that they are the work of man, and may perhaps possess great interest to the Kansas antiquarian, and, with other similar works which may be found, certainly merit investigation as associated with the early expeditions and defenses of our pioneer traders, trappers and others who found their way into the boundless western wilds, a part of which is now dedicated to the progressive civilization of Kansas. But these works clearly cannot be associated with the Mound Builders.

At many places in Kansas stone arrow and spear points, stone axes and hammers, fragments of pottery etc., are found exposed upon the natural surface. Some very good specimens of which have been collected by Judge Adams, in the Historical Department at Topeka, and by private citizens in various parts of the State. Among the latter the most noticeable collection which it was my good fortune to see, was one made by Mr. Melvin Billings, of Marion Centre. This young gentleman has collected some very interesting specimens. As he was from home at the time I called to examine his cabinet, I had not the pleasure of seeing him, so as to ascertain under what circumstances his specimens were found. I have, since reaching home, received a letter from him in which he describes the size of his stone mallets or hammers as being "eleven inches in circumference and four inches long, on the average."

Many of the implements collected in Kansas, as for instance stone hammers, lie upon the boundary between the old and the new, and might be referred to the races of either, but in the absence of better evidence of their greater antiquity, should be referred, no doubt, to our modern tribes.

The pottery found, some of which wears the marks of great antiquity, may have been left by wandering or migrating tribes of Mound Builders, or what is very probable, has been found where deposited by a race of greater antiquity, by modern races, when exposed by the action of water, and taken for use or out of wonder or curiosity, and scattered over the country in limited quantities as found. I am not aware that other than a very limited quantity of pottery has accumu-

lated in any one place in Kansas. The buried vessels used by a prior race and subsequently washed out by successive changes in the river channels might afford sufficient material for all the fragments of pottery found in Kansas.

But, if evidences of a permanent abode of Mound Builders is wanting in Kansas, we have proof of a race of far deeper interest, if measured by its great antiquity. The wandering Mound Builders—if the fragments of antique pottery scattered over the plains of Kansas is to be attributed to them—little dreamed that they were treading over the remains of a buried race which had played its part in the great drama of life, and lay covered beneath the accumulations of the long Lacustrine epoch, embracing perhaps more than a hundred thousand years in the world's history.

The evidence is not meager or wanting in significance that such a race lies buried in Kansas. It is fitting, too, that Kansas, young and aspiring to all that is grand and noble—Kansas, great in her devotion to freedom and the rights of man—great in the fertility of her soil, and her agricultural resources; great in her railroads and industries, great in her boundless plains and fossil remains, should be the theater of such a race.

I must premise here, before entering upon the proofs of an extinct race, that prior to the Drift epoch, our river channels had a much greater depth and our valleys were lower than now. The old channels were filled by the Drift, and in some places changed by it. The valleys were subsequently filled by a Lacustrian deposit. It is in or beneath this that the extinct race lies buried, enwrapped in its profound mystery.

I shall ask your indulgence, if a fitting opportunity offers in the future, of presenting a paper on the Buried River Channels of Kansas in further elucidation of this subject.

The facts which I have to present are not as full and clear in detail as I could wish, but are sufficiently so to sustain the belief in a buried race. Human remains have been found covered up at various depths in seven different counties along or near the Kansas Pacific Railroad, namely: Douglass, Pottawatomie, Riley, Dickinson, Marion, Ellsworth and Lincoln. The remains, with one exception, have all been found in well digging, and on the second bottom or terrace of streams. At Lawrence, Douglass county, in a well sunk on Louisiana street, a rude flint implement was found by Mr. W. H. R. Lykins, of this city, some years back, at a depth of about twenty-eight feet, and described by him in the October number of the Kansas City Review of Science and Industry. The implement is described as being of an "irregular oval or leaf shape pattern, about four and one-half inches long and two and one-fourth inches wide."

On the Limerick farm, Sec. 9, T. 8, R. 9, on Rock creek, in Pottawatomie county, in digging a well Mr. Limerick informed me that some burnt clay, human bones, and arrow points were found at a depth of thirty feet below the surface. At Manhattan, in Riley county, at the confluence of the Big Blue and the Kansas rivers, in digging a well in the city, a small vessel of the true basket type

of pottery capable of holding about three pints was found at a depth of nine feet. It was in the possession of the late Prof. Mudge, whose sad loss is so fresh in our memories. He showed me the vessel and went with me to the place where it was found, and I have every reason to believe with him, that it could not have been covered in by the washing of rains.

On Chapman creek, in Dickinson county, in digging a well, a human skull was found at a depth of twenty-three feet below the surface. The clay, in or beneath which it was found, was compact enough to show the marks of the pick for several years after the work was done. The well was abandoned in consequence of the wife of the gentleman who owned the property being unwilling to use water from it because it contained human remains.

At Marion Center, Marion county, Mr. Billings, in the letter before alluded to, writes: " Among the things which you did not see are the bone instruments from cellars in town." I mention this in connection with the other facts, but it is probable that these implements have been covered in by washings from the adjacent hills.

At Ellsworth, in Ellsworth county, in a well dug on Main street, in the valley of the Smoky Hill river, I am informed by H. T. Hoesman, of that place, that the lower jaw bone of a human being, containing teeth, was found at a depth of twenty-six feet below the surface. Where found was about on a level with the present river bed, and five hundred yards distant from the foot of the hills bounding the valley on the north.

On the west branch of the Elk Horn river, in Lincoln county, I am informed by Mr. J. C. Ryan, that Mr. Thomas Wilson, in digging a well on his farm, in the south-west corner of the county, found three imperfect and one perfect arrow points at a depth of thirty-one feet. Fossil wood was found in the same well at a depth of eighteen feet.

We can hardly doubt the finding of human remains under the circumstances indicated, and we have a right to infer that they are buried in large quantities if we consider that the superficies of a well will not exceed twenty square feet or five feet square, and that there is upon an average, perhaps not more than one well to every square mile of territory in the counties named, or in other words, that the excavations made in well-digging are as twenty square feet or five feet square to one square mile, or the 155,968th part of a mile's surface. We can hardly assume that chance has directed the wells dug where the only human remains are buried, not in one instance alone, but in six different counties.

The facts are sufficient to prove the existence of a buried race and that it must have been very numerous, for if the excavation of the 155,968th of a mile in six different counties, gave in each instance human remains, what should we infer would be the result if the entire territory could be excavated.

But where the evidence is deficient and greatly wanting in detail, is as to the time when this mysterious race lived. Was it before or after the Glacial period? Was it borne down by the glaciers and icebergs from more northern latitudes with

the drift? Or did it occnpy the valleys of Kansas after the Drift epoch and before the Lacustrine deposit? And if so, was it overwhelmed by the waters in which the Lacustrine deposit was precipitated?

These are questions which cannot be answered by the facts now before us and will have to await further developments. The most reasonable snpposition would seem to be in favor of the occupancy of the country after or during the Glacial period and prior to its last submergence, or that in which our Loess deposit took place. But while this is most probable, either of the other hypotheses may be true.

If similar remains should be found in the future it is desirable that they should be carefully saved, and the exact position in which they are found carefully noted. The local newspapers through Kansas wonld do a good work by urging this matter before the people. The grand results to the Archæology of Kansas which may follow would more than compensate the trouble.

Here we have a buried race wrapped in a profound and startling mystery—a race whose appearance and exit in the world's drama precedes stupendous geological changes marking our continent, and which perhaps required hundreds of thousands of years in their accomplishment. The prize is no less than determining when this mysterious people lived, how they lived, when they passed out of existence, and why they became extinct. Could they be recalled from their profound rest, they could tell us, perhaps, of the long, dreary glacial time, instinct with its irresistible forces, and of the deluge of our valleys with the inflowing of mighty volumes of water which buried all in their widely limited pathway.

I must not close without paying a merited tribute to the Kansas Pacific and the Atchison, Topeka & Santa Fé Railroads for the great interest they have always manifested in the development of Kansas, and for the facilities they have so generously extended for scientific investigation along their respective lines, embracing a district of country unsurpassed in fertility of soil, and richness, variability and grandeur of its fossil remains. I must, too, acknowledge the courtesy and aid everywhere extended me by the people of Kansas in my explorations.

THE GREAT PYRAMID—ITS GENERAL CHARACTER.

REV. JAMES FRENCH, DENVER, COLORADO.

There are thirty-eight of these peculiarly shaped, five-cornered monuments, arranged in groups and at comparatively short distances from each other. The Jeesah cluster is the most noted. Among these is the pyramid of Cheops, called the Great Pyramid, which stands preëminent over all others in age, magnitude and mechanism. But its special preëminence consists in its manifest purpose. In this respect it stands alone. All of the others are lifeless imitations, lacking the most distinguishing characteristics of this, just as a statue lacks a soul. If either of the others contained the symbols or coincidences which we find in this, we

should feel inclined to allow the Egyptians, as a people, more credit for what we discover here, and would say, with Dr. Field: "It is evident that they were able to measure the solar system as exactly as modern astronomers." (See From Egypt to Japan, p. 59.) But the Great Pyramid, though classed with many others, stands out unmatched, single in kind, and unequaled in character, the oldest and most perfect, first. Do man's works begin thus? Is it not invariable and in accordance with the law of his nature, always and everywhere, that he improves by practice and instruction? Is there not an acknowledged ascending scale with progress from the crude and less accurate to the more beautiful and correct in every work of the human species? This gradual advancement in knowledge and the mechanic arts is what distinguishes the species of animals called homo from those below us, which are guided by mere instinct. A bird builds no better or different kind of nest now than the bird of its kind did one thousand years ago. So of the bee. It is a wonderful little geometrician, but it is not so by practice or instruction. It never improves. But man does improve by both practice and instruction. This is his distinguishing characteristic, and is in accordance with a law of his being.

Now the Great Pyramid in this respect is unique, and presents this law of man's nature reversed; for his best and highest attainments are first. *It is a sudden presentation of approximate perfection in science and mechanic arts in advance of any known means of obtaining them, monumentally commemorated.*

Strabo, who saw it when complete in finish, with its beveled casing stones in their places undisturbed, before it had been mutilated by Musselman's polluted hands, declared "it looked as if it had descended upon its site really formed from heaven, and had not been erected by man's laborious toil at all."

Diodorus said "it seemed as if placed on the surrounding sand by the aid of some deity, rather than by the sole and gradual operations of man."

There is no more real resemblance between the Great Pyramid and the others than there was between Moses' rod and the rods of the magicians.

This distinction in kind is like that between the true God and the Egyptian mythological gods; or, like that between the true Christ and the Pagan mythological Christs; or, like that between the Bible and the so-called sacred books of the heathen.

We have waited patiently for an explanation of this peculiarity in this structure on some hypothesis which would not involve the absolute necessity of superhuman guidance in its construction. But this *unique* characteristic, by all critics, is ignored.

Mr. Edison finds that platinum, after it has been rendered homogeneous under the vacuum-treatment, is dissolved with great difficulty in boiling aqua regia. He subjected a specimen of the vacuum-treated platinum to the action of boiling aqua regia for five days without dissolving it.

GEOGRAPHY.

ANCIENT GEOGRAPHY OF AMERICA.

BY CAPT. E. L. BERTHOUD, GOLDEN, COLORADO.

We have before us a rare old work, dated 1597, which purports to be "a full and complete manual of ancient and modern Geography, modeled and made up in accordance with the geographical system of Ptolemy; its author, Antonio Magino Patavino, Professor of Mathematics in the Gymnasium of Bologna; printed at Cologne." It is, for that time, a very creditable work, and the maps are well executed.

Naturally, we have taken up that part of modern geography in which Patavino gives us the latest information concerning what he calls the "'*Novus Orbis,*' *dicta fuit* '*America,*' *ab Americo Vespucio Florentino.*" Again he says, "*A nonullis etiam Atlantica vocatur, atque etiam* '*India Occidentalis,*'" adding that the last name given to this new world is on account of the resemblance between its natives and those of the East Indies, in that they are nearly naked.

Patavino gives us, in his Geographical Manual, detailed maps of every country and kingdom in the then known world. His map to illustrate the text of his description of North and South America is a very fair approximate sketch of these two continents, but is not as complete as his first map, on page 29, which explains a chapter entitled "*Universi orbis terreni, secundum recentiorem nostri temporis rationem descriptio*"—a description of the whole terrestrial orb according to the most recent knowledge of our time. This map represents Europe, Asia, Africa and the Americas, with an Antarctic continent called "*Terra Australis nondum cognita.*" It is drawn with a perfection approaching that of Mercator, and is in size seven inches by about four inches. The Arctic regions show also in their whole extent a body of land divided into four separate parts. The two center parts are called Grutlandia, and the two other parts are called Terra Incognita. We notice, however, that the east end of Grutlandia is called "Nova Zemla." Evidently the discoveries of Barentz were unknown then to Patavino, and he was also ignorant of the existence of Spitzbergen, etc., etc., which go unnamed and unknown.

In the New World part, Hudson's Bay is distinctly shown, while the existence of a strait between North America and Asia is plainly and distinctly indicated. Our present territory of Alaska is shown on the map under the name of *Anian Regnum,* "the Kingdom of Anian," derived from the probable mythical account of the voyage of Maldonado from Baffin's Bay to the North Pacific—so long believed in the sixteenth and seventeenth centuries—who claimed to have discovered this northwest passage and the Strait of Anian. Oregon and Washington Territory are called by the name of Quivira, and Columbia River appears also, its

course from northeast to southwest being about what would be the average direction of Clark's Fork.

Geography is not always a progressive science, whatever claims we may make in this century that we have remodeled all geographical knowledge, whether ancient or modern. Patavino's manual well illustrates this, for we have in this map a very correct outline of the peninsula of Lower California, and of the great Colorado and Virgin rivers, the Colorado River shown as rising west of a range of mountains, evidently our Rocky Mountains, with another range west of them which well represents the general course of the Wahsatch and Uinta mountains. Now we have also in our possession an edition of Dampier's Voyages of 1702–4, and a still later edition of Shelvoke's Voyage Around the World, and in the maps of North America given in both of these works, California is shown as an island, while the Strait of Anian is placed in about the latitude of Queen Charlotte's Sound—a very complete retrogression from the time of Patavino. We shall again advert to other like changes.

Continuing east and south, we have Mexico under the name of "Hispania Nova." Florida is marked also, and appears to include within its limits Georgia, Alabama and Mississippi. The Mississippi and Rio del Norte are shown, but much abbreviated and nameless. Canada seems to be a river, possibly the Ottawa, while the Saint Lawrence is well delineated, the region north of it being called "Nova Francia," *i. e.*, New France, then a late acquisition of France and discovery of Jacques Carrtier. None of the Great Lakes appear, but a location in the interior is named "Chilaga"—query, "Hochelaga?"

If now we turn to the larger map of America, which, at page 278, represents only the New World, we see that the districts of North America now called Manitoba, Montana, Idaho, Dakota, Wyoming, Colorado, etc., are a vast blank, which has this legend on the map: "*Ulterius septentrionem versus hae regiones incognitæ ad huc sunt;*" that is, that this country, and the regions beyond to the north, "are yet unknown." This afterward was considered part of the "Great American Desert" (?).

In this map South America is represented as separated from a vast Antarctic continent by the *Fretum Magellanicum*, or Straits of Magellan, the land south of the strait being called as to-day, Tierra del Fuego, or "Land of Fire," Cape Horn, or the Straits of Le Maire, having been discovered only in the early part of the next century, 1615–18. Tierra del Fuego, however, forms but a small portion of the Antarctic Continent, which was then supposed to extend around the whole South Pole, and was called in that part which in modern maps includes Australia, *Nova Guinea*, or *Terr a Australis nondum cognita*. Patavino is here a little mixed up. In his small map, on page 29, he gives us New Guinea as an island, but tells us this is not yet a *settled point*, although he claims that it was seen by one Andrea Corsalus, a Florentine.

The part of the Antarctic Continent represented opposite Africa is called, in the small map, *Psittacorum Regio*, or the "Region of Parrots," a name given to it

by the Portuguese, he tells us, from the incredible number of these birds and their large size. We to-day cannot easily see how such an absurdity could have originated, unless we suppose that the early Portuguese navigators mistook penguins fot parrots. In the sixteenth century science had, at the best, but very crude ideas of the correlation of latitude, altitude and temperature. The anomalies of meteorology, time and temperature were almost unknown. Hence it is not at all surprising that, as late as 1734–1770, the existence of an Antarctic continent southeast of the Cape of Good Hope was carefully sought for by the French upon the reported discovery, in the sixteenth century, by one Paulmièr de Gonneville, of a temperate, semi-tropical country, where he landed after having been for a long time driven by storms in a southeast direction from the cape. He found, he said, a warm climate, a large river, and a population of dark-colored natives—who received him well—with such a vegetation that it plainly indicates that the imperfect methods of navigation of that period (A. D. 1508–10) had, by means of adverse winds and the currents, thrown De Gonneville on the shores of Madagascar.

(*To be continued.*)

GEOGRAPHICAL NOTES.

ARCTIC RESEARCH.

At a recent meeting of the Royal Geographical Society, Commander Beaumont, of the Nares expedition, read an interesting paper on the subject of future Arctic expeditions. He maintained that, in spite of the unfortunate controversies which followed the return of the late Arctic expedition, the discovery of the unknown world would never be permanently abandoned, and the Arctic regions, in common with the rest of the world, would surely be discovered and explored. He addressed himself chiefly to the question, Which route affords the best promise of geographical and scientific discovery? Franz-Josef Land seemed, at first sight, to fulfill the conditions required to insure success. Here the land extends far to the north, and, if any part of the shore could be reached by a ship, a sledging party might certainly attain to the 86th parallel. But the disadvantages of the route are, that it is uncertain whether a vessel could reach the land, while there would be no alternative after starting but to succeed or fail—if the main land were not gained, no lesser useful work could be done.

The next route, in his opinion, now that the Northeast Passage has been achieved, was the exploration of the land about Cape Britannia, proceeding by way of Smith Sound; that is, the discovery of the northern side of Greenland. He preferred this route to an attempt along the eastern side, because a higher latitude can be reached by Smith Sound, and believed that a vessel might winter on

the eastern shore of Robeson Strait, and advance depots to Repulse Harbor in the autumn. He had seen Cape Britannia, the most northern known point of Greenland, and believed that to stand on its highest peak would throw much light on Greenland geography. He then submitted calculations, derived from his own experience, of the time that it would take for a sledge party to reach Cape Britannia, and discussed the nature of the ice, concluding by offering several valuable suggestions for improved appliances in traveling over soft and deep snow.

AFRICAN EXPLORATION.

THE GERMAN EXPEDITION.

The German expedition under Gerhard Rohlfs has failed, and will probably have to be abandoned. This well equipped expedition, sent out by the African Society at Berlin to cross the Sahara at Wadai and go on to the Congo, left Tripolis in December last, passed through Sokna January 24, and arrived at the oasis of Jalo in April. Here further progress was checked by the hostility of the fanatical natives. Ever since the last Russo-Turkish war, perfect anarchy prevails in the province of Tripolis, where the Mohammedan brotherhood of the Snussi reigns supreme through terrorism. Their chief, Sidi el Madhi, issued orders to allow no Christians to go on to the southern oasis of Kufarah, and, though many natives are well acquainted with the road, Rohlfs offered one thousand Maria Theresa dollars for a guide in vain. Two attempts were made by the fanatics to stone him, and many of his servants deserted through fear. After six weeks' delay Rohlfs, with his companion, Dr. Stecker, returned to the port of Bengazi, on the Mediterranean, where, through the powerful influence of the German ambassador at Constantinople, they succeeded in obtaining from Ali Kemali, the new vali (governor) of the Cyrenaika, an escort of thirty Arabs of the Sulyah tribe, who, for the price of 1,500 Maria Theresa dollars, agreed to accompany the expedition through Kufarah to Abeshr, the capital of Wadai. On July 4 they left Bengazi and passed through Jalo for the second time, the baggage being carried by twenty-two camels. July 25 the expedition reached the oasis of Batifal, twenty-eight kilometers south of Jalo, and, after four days' rest, went on to the great Kufarah group of oases, which has never before been visited by Europeans. They crossed the intervening tract of sand-hills in ten days, and reached the northernmost oasis, Siren, and arrived at Istat, the capital of Kebabo, the southern group, in the middle of August. Rohlfs succeeded in thoroughly exploring the entire Kufarah oasis, but when about to continue the march south the expedition was set upon by the hostile natives and robbed of all baggage and possessions, the escort offering no protection, so that Rohlfs and Stecker were barely able to find their way back to Bengazi, where they remain at present. Though they expect an indemnity from the Turkish provincial government for their losses, there seems but little doubt that Rohlfs will abandon the expedition, as he has already once before sent in his

resignation. The exploration of Kufarah will, therefore, be the only result of this costly expedition.

THE THREE BELGIAN EXPEDITIONS.

The three Belgian expeditions of the International African Association at Brussells have, meanwhile, succeeded in making better progress. The first expedition, under Lieut. Cambier and Dr. Dutrieux, which left Bagamoyo, on the Zanzibar coast, in July, 1878, after passing the entire rainy season at Tabora, the Arab capital of Unyanyembe, has now gone on to Lake Tanganyika. Dr. Dutrieux, however, returns to Zanzibar on account of differences with the leader.

Expedition No. 2, under Capt. Popelin and Dr. Van Henwel, who started from Brussels in April last, was organized at Zanzibar by Henry M. Stanley, and left for Bagamoyo June 28. Twelve days later it started for the interior by Stanley's old road. While crossing the Makata the leaders suffered much from fever, but after reaching Mpwapwa, August 10, they rapidly recovered.

The third expedition left Dar-es-Salaam, on the coast, July 2, accompanied by the four elephants presented to the expedition by the King of Belgium. These animals were brought by steamer from Bombay to Zanzibar and landed, June 1, in the Msasani Bay, near Dar-es-Salaam. They are employed as carriers, each elephant carrying 4,000 pounds of goods. Great fear was entertained that they might succumb to the bite of the dreaded "tse-tse" fly, which kills all other animals of burden; but they have since passed through the districts infested by this insect, and, though well bitten, have shown no bad results therefrom, thus proving the experiment of employing them in the service of African exploration a great success. They crossed mountains, streams, swamps and gulches with ease; but their native Indian mahouts suffered severely from fever. This expedition arrived a few days after the second party at Mpwapwa, where both combined, and on September 2 continued their march west. At Ujiji, on the Tanganyika, all three Belgian expeditions will effect a junction.

No later news has arrived from

THE FRENCH AND ENGLISH MISSIONS ON LAKE NYANZA.

The French expedition, under Abbé Deblaize, reached Ujiji on April 2 last, 250 days from the coast, and intended to go on through Manyuema to Nyangwe, on the Lualaba-Congo. The English expedition, under Keith Johnstone, has not disbanded in consequence of the sad death of its leader, which occurred June 28, after twenty days' illness, of dysentery, at Berobero, in Kutuland, 150 miles southwest from Dar-es-Salaam, from where the expedition started May 14. Mr. Thompson, the geologist of the expedition, has taken command, and gone on through Uherge to Lake Nyassa, where he is probably busy at present exploring the north end. From there he intends crossing the unknown regions to the south end of Tanganyika, returning by way of Ujiji and Unyanyembe to the east coast. Keith Johnstone, before starting from Zanzibar on his ill-fated journey, made a

short trip into Usambara. He did not reach the capital, Tuga, but plainly saw the town from the Handei hills, and by his estimate places it nearly twenty-five miles northwest of the position assigned to it by Burton and Speke twenty years ago.

The missions in the lake regions have not progressed very favorably thus far. The Church Missionary Society's station, under Rev. Mr. Wilson, at Rubaga, King Mtesa's capital, on the north shore of Victoria Nyanza, was reinforced early in the year by three additional missionaries, who went up the Nile to Uganda. King Mtesa treated the mission well, and, owing to their representations, even abolished slavery in all his dominions. Recent advices state, however, that he has turned unfriendly and suspicious on acount of the near approach of the Egyptian advanced posts to his frontier, which he attributes to the mission's complicity. Still he has allowed two of the members to go with some of his messengers to Col. Gordon to protest against his advance. Mr. Felkins reached the Egyptian post Fatiko in May last, while Mr. Wilson was still on Uganda territory June 26, accompanied by four chiefs. Two other members have been permitted to go to the south shore of the lake to send up some stores, which arrived there from Zanzibar, and the remaining three missionaries are still at Mtesa's court under surveillance.

After the death of Rev. Mr. Thomson, the head of the Tanganyika mission, at Ujiji, in October last, the London Missionary Society sent out Dr. Mullens, its former secretary, to reorganize the mission. He reached Mpwapwa, on the road to the lake, and there suddenly died, July 10, of peritonitis. His companion, Rev. Mr. Dodgshun, went on to Ujiji, but, seven days after his arrival there, he also fell a victim to the murderous climate. Since then the Society has received no news from the surviving members of the station, Rev. Mr. Hutley and Mr. Hore, the naturalist, and has, therefore, asked Dr. Laws, the chief of the Livingstone station on Lake Nyassa, to send trustworthy native messengers to Ujiji and bring back letters.

The Catholic mission, under Father Livinhac, arrived at Kaduma, on the southwest shore of Victoria Nyanza, in January last, and two of its members went in boats to Uganda to obtain King Mtesa's consent for founding a station in his country. Meanwhile the reinforcements for the Catholic mission at the lakes sailed from Algiers June 29 for Zanzibar. They comprise twelve missionaries and six former Pontifical zouaves of German, Scotch and Belgian nationality.

ITALIAN, SPANISH AND PORTUGUESE EXPEDITIONS.

The Italian expedition to Southern Abyssinia, under Capt. Martini, sailed from Leghorn in March last, and arrived at the port of Feila, on the Red Sea. Here they were unable to procure means of transportation, owing to the Emir's hostility, so that Capt. Martini was forced to abandon his projected expedition to Shoa and Central Africa, and returned to Civita Vecchia by the steamer Rapido on August 3. The Marquis Antinori has meanwhile pushed on far to the south-

west, beyond Kaffa, but nothing positive is known as to his whereabouts, and rumors of his death have come in.

The Portuguese, on the west coast, have also failed to accomplish much. The expedition under Lieuts. Ivens and Capello were on the banks of the Luculla, a tributary of the Quanza, in April last, and explored the Cubango region, following down this river from its source to the eighth degree of latitude. On July 24 they arrived at Dugue de Braganza, a military post on the Upper Luculla, destitute of means for proceeding further. The government has since forwarded fresh supplies, and by the latest accounts the explorers were at Golungo Alto, in the province of Angola, on their way back to Loanda, on the coast, where they were expected to arrive in December.

Major Serpa Pinto, the leader of the Portuguese expedition which crossed Africa from west to east in 300 days, is at present very ill at Brussels, where he represented his government at the International African Conference. The publication of his book will, therefore, probably be delayed. Its title will be "The King's Rifle, from the Atlantic to the Indian Ocean, Through Unknown Countries, and the Discovery of the Great Zambezi Tributaries." It is to be published simultaneously in English, French, German and Portuguese, and will contain many engravings and fifteen maps.

A new Portuguese expedition has just left Lisbon for the east coast. Lieut. Pavia de Andrada, with a staff of several engineers and a physician, has been sent out by his government to Mozambique to make new surveys of the Zambezi River and establish trading stations on the old sites of Tete and Zumbo, on that river, and the westernmost posts of the Portuguese, but which have been abandoned for years. For this purpose the expedition has received a twenty years' prerogative on all minerals to be discovered, and on the woods, as well as a grant of 100,000 hectares of land from the government.

The Spanish expedition, which the Geographical Society of Madrid sends out under the leadership of Señor Albergues, will be the first one of that nationality taking part in African exploration. The expedition will, on its way to Central Africa, take along presents from King Alfonso for the kings of Abyssinia and Shoa, through whose dominions it intends to pass. The Prince hereditary of Monaco will be a member of this expedition, which he joins at Marseilles.

NEW EXPEDITIONS.

The Russian traveler, Dr. Junker, who has already made extensive explorations in the White Nile countries, is at present in Berlin, making preparations for a great expedition by way of Egypt to the Soudan and the Monbuttu country, where he intends to continue Dr. Schweinfurth's researches among the Niamniam cannibals and the Acka dwarfs, and, if possible, cross the Welle River.

Dr. Oscar Lenz, the explorer of the Ogowai, has again been sent out by the African Society at Berlin, to explore the unknown parts of Morocco, there to become acquainted with Mohammedan manners and language and then go on to the Soudan. He left Vienna last month for Tangiers.

The French traveler Soluillet, who recently failed in his attempt to reach Timbuctoo, will be sent out by his government to explore the Sahara between the fifteenth and twenty-fifth degrees of north latitude, in connection with the grand project for connecting the French colonies at the Sinegal with Algiers by an overland railroad.

Dr. Emil Holub, who has just returned to Europe from seven years' explorations in South Africa, which took him to the Victoria Falls of the Zambezi and beyond that river, intends to form a new international expedition, with twelve members of various nations, for further explorations in Central Africa.

The Germans, on the ●est coast, have accomplished some valuable work. Engineer Otto Schutte has returned to Berlin after a successful expedition, in the course of which he followed down the Cassai River, one of the Congo's great affluents, through unknown regions to the sixth degree of south latitude. He had penetrated within two days' march of the great cataracts, when he was stopped by the native King Mai. The Cassai was then known by the Congo's old name, Zaire. The Sankorra Lake was said to be near the fifth degree. The natives call it Mucaruba, and say its south shore is inhabited by dwarfs. Mr. Schutte went on to the Mwata Yanoo's capital; but here, like his predecessor Pogge, he was prevented from going further and had to return to Loanda. The German African Society has received no later news from its other explorers—Dr Buchner, who has gone up the Quanza to take the German Emperor's presents to the Mwata Yanoo, and Major Mechow, who attempted to ascend the Quanza and return by way of the Congo.

Donald McKackenzie has succeeded at last in establishing his trading station near Cape Juby. He settled eighteen men in the wooden houses brought from England and set up near Port Victoria, and has come back for more settlers and fresh supplies. Sheik Mohammed Beyrout, the ruler of that district, is very friendly and desires to trade with the station.

IN THE UPPER NILE REGIONS

the change of the Egyptian ruler and Col. Gordon's abdication will necessitate a withdrawal of the far advanced posts and a change of the southern frontier. The slave trade in the White Nile country has now been completely stamped out by Gordon ånd Gessi. Mr. Bohndorf, Gordon Pasha's valet, claims to have penetrated far beyond King Mofio's territory west of the Dar Fertit. He crossed the Bahr Shimko flowing west, but after six days' march further he was forced to turn back by the cannibalism of the natives. He heard therethat the country southwest of Mofio's is called Dar Tikma, and that a large river, named Umbomo, flows through it to the west.

Mr. Duchta has just returned to Chartum,after passing last winter in Unyoro and Uganda, where he succeeded in taking a great number of photographic negatives of the scenery and the natives.

Dr. Enim Effendi has sent in a complete account of his expedition through Unyoro to King Mtesa's capital.

Dr. Schweinfürth, since finishing his map of the Fayoum, is now at work on a new chart of the Arabian Desert in eastern Egypt, on a scale of 1:200,000, based on his own explorations and those of his predecessors.

THE AFRICAN ISLANDS.

Col. Austen has been sent by the British government to the Island of Socotra, at the entrance to the Red Sea, to make a thorough exploration of this new possession.

The German geographers, Drs. Greef and Gesser, are at present employed in visiting the western African islands—Azores, Madeira and Canaries Dr. Hillebrand is exploring the still unknown portions of central Madagascar, as successor to Dr. Rutenberg, who was murdered last year by the natives.

A settlement has recently been formed by forty Norwegians on the small Aldabra Islands, thirty miles north of Madagascar.

THE NORTHEAST PASSAGE.

The expedition sent by the Russian government at the beginning of the present year has just returned to St. Petersburg. This expedition was dispatched to the mouth of the Obi, under the direction of Captain Moisejeff, of the Imperial Navy, as soon as the sea passage to the Siberian rivers had been proved to be practicable by Professor Nordenskjold, Captain Wiggins and others, and its object was to investigate the river mouths, lay down signs and generally render navigation as convenient and safe as possible. Captain Moisejeff took his steamer down the Obi from Tobolsk to the mouth of the small river Neda or Nadym, where steamers generally load and discharge their cargoes, and from that point made his preliminary investigations of the difficulties and requirements of navigation in the, comparatively speaking, newly opened water way. The results of his investigation he is now embodying in a report. It is strange, he says, that of eight steamers, mostly English, which have attempted this year to pass the Kara Sea, only the Louisa, a Russian steamer, has apparently succeeded in the enterprise. Next year it is proposed to send a much larger expedition to complete the laying down of signs and to establish the custom house regulations.

NORDENKSJOLD'S REPORTS.

The following scientific papers have been received by Mr. Oscar Dickson at Gothenburg, from the members of the exploring party who have accompanied Professor Nordenskjold, and will shortly appear in print: "Of the possibility of Trading in the Siberian Arctic Seas," by Professor Nordenskjold, and dedicated to the King of Sweden; "Of the position of the Aurora Borealis in Space," and "The Habits and Customs of the Tschuktschers," by the same; "Dictionary of

the Tschuktschers' Language," by M. O. Nordkvist; "Studies on the Sense of Color of the Tschuktschers," and "Lichnologic Researches on the North Coast of Siberia," by M. E. Almquist; "Of the vegetation of the Algæ in the Siberian Arctic Seas," and "Of the Vegetation on the North Coast of Siberia," by M. F. R. Kyellman; "Of the Fauna of the Invertebrata in the Siberian Arctic Sea," by M. Anton Stuxberg. Several of these papers are accompanied by drawings, illustrations and charts showing how hard and conscientiously the explorers have worked.

DEATH OF A YOUNG EXPLORER.

According to telegraphic information received by the Secretary of the Navy, at The Hague, Mr. L. R. Koolemans Beynen, the young lieutenant in the Dutch navy who had already established a great reputation by his exertions to forward the Arctic explorations, was "killed by accident" (unknown yet of what nature), on board of Her Majesty's steamer Macassar, then on a cruise in the Borneo waters. Mr. Beynen's first voyages to the Arctics were on board the Pandora, under the command of Sir Allan Young, which competent judge always speaks of him in the most laudatory way. On his return to Holland it became his most cherished object to have again the Dutch flag float in those regions which had formerly been so familiar to it, and chiefly by his personal enthusiastic representations, backed by a few other champions for the Arctic cause, he carried his countrymen to his point, and on his initiative the Willem Barentz was built and a truly national expedition to the Polar Seas got up. The results of the two expeditions which this vessel made, under the command of Lieutenant de Bruyne, are already well known to you. On her first trip, in 1878, Mr. Beynen was one of the officers, and he would have been but too glad to join the second had he not been transferred to the Dutch East India squadron.

ARCTIC EXPLORATION.

BANQUET TO PROFESSOR NORDENSKJOLD AT NAGASAKI.

A grand banquet was given to Professor Nordenskjold at the theater on the evening of the 22d of October. Mr. Mangam, the United States Consul, presided as Doyen of the Consular Corps. Opposite to him was the famous explorer Mr. Olarovski. The Russian Consul presided at one end of one of the long tables, and Dr. Salter of the Government School of Nagasaki, presided at the other, assisted by the stewards of the evening, gentlemen representing ten different nationalities at the port. There were eighty-eight guests, and speeches were made in eight different languages The room was profusely decorated with flags of all nations and a profusion of the beautiful evergreens and flowers of Japan. Admiral Patterson, of the flagship Richmond, kindly loaned the band for the occasion, and the affair was a great success. The speeches were delivered in Norwegian,

Swedish, German, Dutch, French, Japanese, Chinese and English. The toasts and speeches were as follows:

1 "The Crowned Heads and Presidents of all the Nationalities," by Mr. Magnum, United States Consul.

2. "Professor Nordenskjold," to which the explorer replied in Swedish.

3. "Captain Polander and the Members of the Expedition," by Mr. Rocher, Acting Consul for Sweden and Norway. Mr. Rocher spoke in German and Captain Polander, of the Vega, replied in English.

4. "The Promoters of the Expedition," by Mr. Flencker, Consnl for Denmark. Mr. Flencker spoke in Norwegian.

5. "The Army and Navy of the different Nationalities," by Dr. Salter. Captain Benham, the commander of the Richmond, replied.

6. "Professor Nordenskjold," by Mr. Won-Ven-King. Mr. Won-Ven-King spoke in Chinese, and his speech was translated into English by Mr. Leong, the interpreter of the Chinese Consulate at Nagasaki.

7. "Professor Nordenskjold," by Mr. Segar, late Secretary of the Japanese Legation at St. Petersburg.

8. "Previous Expeditions to the Arctic Regions," by Dr. Fock, of the Imperial Japanese hospital at Nagasaki. Dr. Fock spoke in Dutch.

9. "The Geographical Societies of the World," by Mr. Olarovsky, Russian Consul. Mr. Olarovsky spoke in French, although he is at home in many tongues

Mr. Olarovsky proposed the health of Captain Aldrich, of the Sylvia, Her Britannic Majesty's gunboat stationed at Nagasaki. Captain Aldrich was lieutenant of the Discovery, the companion ship of the Alert, of the Nares expedition, and has the credit of having gone nearer the arctic circle than any other navigator. Mr. Olarovski's speech was in English, and Captain Aldrich's reply was brief but excellent.

The invitations in front of each guest's plate were etched in water colors, with appropriate views of Arctic scenery, the work of a Japanese artist, from designs furnished by the committee. The drop curtain represented the ever glowing Fugiama, the glory of Japan, and a view of the ever beautiful Setouchi, the inland sea of Japan. I do not think that New York, London, Paris, Berlin or Vienna could have exceeded the taste displayed in the whole affair. The assemblage was polyglottal, and this gave a picturesqueness to the scene.

COMMANDER CHEYNE'S PROPOSED EXPEDITION TO THE POLAR REGIONS.

Commander Cheyne, R. N., delivered on the 20th ult., a lecture in the City Hall at Glasgow, on the subject of his proposed Polar Expedition. Sir James Bain, who presided, said, in introducing the gallant commander, that there had been already a meeting in Willis' Rooms, London, on the subject, at which a proposal was made by Mr. Puliston, M. P., seconded by Mr. J. Newton, C. E.,

President of the Association of Foremen Engineers and Draughtsmen, and carried, to the effect "that in view of the completion of the northeast passage by Sweden and the entry by other nations into the arena of Arctic exploration, it is necessary that a new British expedition be immediately organized to act in concert with the expeditions of other nations for general scientific results, and to honorably compete with them for the discovery of the North Pole; that such expedition shall consist of one steamer, having balloons as a recognized portion of the equipment, at a total expense of thirty thousand pounds, to be raised by public subscriptions throughout the country." Another resolution had been adopted inaugurating the London Central Arctic Committee for England, of which Dr. Cameron, member for Glasgow, had since consented to become a member as a representative for Scotland. Commander Cheyne, who was received with applause, said that it was with untold satisfaction that that morning he had again crossed the Tweed to the land of his forefathers, which had led the way in Arctic exploration. He had so applied the spur to England through Scotland that he hoped he had dragged her to the front, and when Scotland had once taken a thing in hand it was not within the scope of the Scottish character to withdraw. We all now acknowledge that it would be a great disgrace to this nation if, after the partial failure that had lately taken place—a failure in some things, but a success perhaps in others—we should sit down quietly in our rooms and cry *peccavi*, and wrap ourselves up in blankets and say "we are beaten." Such was not the course pursued either by the Duke of Wellington or Nelson, and such would not be the course pursued by any leader or leaders in our country as long as Scotch and English blood circulated through them. The Canadian, Sir John McDonald, had promised support to the expedition, and Sir Leonard Tilley, Minister of Finance for Canada, had said to him: "If you break down in this country for want of funds, come to Canada and I think we can do it for you ourselves." He didn't want Canada to do the work herself. He wanted to unite the two countries and to form a British-Canadian expedition with good strong Scottish help.

The gallant commander then, with the aid of the magic lantern and dissolving views, described graphically the vicissitudes an expedition has to go through in its voyage toward the Pole, according to his own experience. Alluding to the last exploration, he remarked that it was not the want of lime juice on the sledges that had broken down the crew, but the keeping the men between badly ventilated decks and not allowing them fresh air. Much information he imparted about the oceanic currents and the nature of the ocean's bottom, the latter taken from the soundings of Her Majesty's ship Valorous, in Davis Strait and the Atlantic Ocean. The route he proposed to take—on the ship fitted out for Captain Nares' last expedition, which he intended to ask from the government—was by Barrow Strait, Wellington Channel, through Queen's Channel, where he will winter on the station gained by Captain Nares, and thence into the unknown by means of sledges and balloons, in a north-northwest course to—not toward—the Pole. Among the views he exhibited were sketches of the remains, as first found, of graves of

the seamen belonging to the Franklin expedition in Beachy Island, and a capital portrait of Sir John Franklin. While these were passing through the lantern Mr. Cornwall played in magnificent style on the organ "The Dead March in Saul," and Commander Cheyne afterward remarked that if they could only throw as much spirit into the British public as the organist had thrown into the march we should soon have the North Pole discovered. Having described the method of his intended ballooning enterprise, and brought the good ship back into Portsmouth, he closed his admirable lecture by showing a portrait of the Queen, and said there appeared to him but one jewel wanting in the crown of Her Majesty, and that was the British colors flying at the North Pole. We did, he owned, want to annex more territory, but only to take it from the Polar bears, and there would be no heart-burnings over that. He hoped that we should yet be able, figuratively speaking, to create Her Majesty "Queen of the North." (Loud applause.) Before concluding he reported what support he had met with in England, what was intended to be done in Ireland, and hoped the Central Committee already formed in Glasgow would work well, and trusted that Scotland, having come by herself to the front, might reap the reward of her enterprise. As for himself, he had pledged his word as a Scotchman to do what he could to accomplish the discovery of the North Pole.

MARKHAM'S RECENT VOYAGE.

At the last meeting of the Royal Geographical society, Lord Northbrook presiding, a paper by Captain A. H. Markham, who is not in England at present, "On the Arctic campaign of 1879, in the Barentz Sea," was read by the honorable secretary. Captain Markham considered that the present year must always be regarded as a very remarkable one in the annals of Arctic exploration, for during the last few months two important geographical problems had been successfully solved. The Swedish ship Vega, under the leadership of Nordenskjold, completed her voyage from the Atlantic to the Pacific by rounding the northern termination of the Old World—a voyage which even if it should not prove important in a commercial sense, would always rank as one of the greatest geographical feats of the present century. And secondly, a small sailing schooner had reached the hitherto inaccessible shores of Franz Josef Land. He said inaccessible because the Tegethoff, the only vessel that had ever approached this coast, had been carried thither by the ice in which she had been helplessly beset for two years, an imprisonment from which her officers were never able to extricate her. The vessel that had so successfully accomplished the latter feat was the little Dutch exploring schooner Willem Barentz. His own cruise this year, although undertaken in only a little sailing cutter of forty-three tons burden, was, as far as it went, perfectly successful and had tended very materially to strengthen his previous opinions that the route by Franz Josef Land is the one that will lead to the discovery of the greatest extent of previously unknown country. Though

successful in a geographical point of view, his trip would have been more so had it not been for the unwillingness evinced by the Norwegian crew to face the ice. The conception of the cruise was entirely due to their newly elected associate, Sir Henry Gore Booth. Early in the year he gladly accepted Sir Henry's invitation to accompany him on a sporting trip to Novaya Zemlya, with the understanding that they should afterward examine the ice in the Barentz Sea and other localities, during what he considered to be the navigable season—namely, the month of September. For their cruise he had hired the little Norwegian cutter Isbjorn, already rendered historical by her exploits under Payer and Count Wilczek. He could not help strongly expressing his opinion regarding the employment of vessels unprovided with steam power in exploring the icy seas. At the very moment when the ice is more open than at any other time—namely, in a calm, a sailing vessel is perfectly helpless, and at other times, when there is a fair wind through the pack, it would be imprudent for a commander to run on, because to extricate himself from the ice he would have to work to windward in an ice-blocked channel. Although most successful work had been accomplished in the Arctic seas by sailing ships, there was no doubt that had those vessels been steamers much more would have been achieved. Yet this year we had an example of a small sailing vessel not only reaching, but also returning from, a country which a steamer approached, in 1873, by being helplessly drifted in the ice, only to leave her timbers bleaching on the shore There was little doubt that had the Willem Barentz possessed steam power she would this year have made one of the most brilliant and successful summer cruises in the Arctic seas ever recorded. It was only by perseverence that success could be commanded in the Arctic seas. He would now propose that a vessel (and one was quite sufficient), should be sent out to Franz Josef Land prepared to winter. Should the season be unfavorable, and the vessel be unable to reach her destination, the commander ought to be instructed to return to England and be sent out the following year. But from a comparison of all the voyages which he had enumerated, he was inclined to think that a steamer would have no difficulty in reaching the south coast of Franz Josef Land during the last week in August or during the first two weeks in September.

ASTRONOMY.

NOTE ON JUPITER'S SPOTS.

BY PROFESSOR C. W. PRITCHETT, MORRISON OBSERVATORY.

EDITOR OF REVIEW: As the paper of Mr. Dawson in your November number contains a notice of the very remarkable rose-tinted spot on Jupiter, allow me to say, I have made a large number of observations of the transit of this spot over the central meridian of this planet. In advance of the full discussion of these o

servations, relatively to the aërial rotation, and other physical phenomena, one very notable fact may be deduced from them. I will state it disjunctively. Either the spot has retrograded since August 6th, through 21° of longitude, or the received value of the planet's rotation (9.92 hours), is too small. Has this singular elliptical cloud an actual motion of translation on the Jovian surface? This is a question of profound physical interest, and can only be answered (if it can be answered at all), by close and patient observation. I have invoked observations, directed to this end, from astronomers in our own country and in Europe. Having tried to do something myself in this direction, I find the spot to keep its place well relatively to certain gray triangular and notched masses in the south—preceding quadrant of Jupiter; while the varying spots and cloud masses between the two great equatorial belts have been observed to change place very rapidly relative to this spot south of them. Some of them have been observed to move in the space of three days, along the whole length of the spot. There seems to be strong evidence that the region of great activity (visible to us), or of visible motion of translation on the Jovian surface is within the equatorial zone, and that the spot is so far south of this zone as to be unaffected by it. If, however, this spot has an actual motion of translation, it must be in a direction contrary to that of the middle zone. Jupiter is now so far past apposition that observations made during the next few weeks can not be so valuable as those made a few months ago. But the spot having now lasted more than seventeen months, it is to be hoped that it can be observed through another apposition. In form, size and color it still maintains a surprising persistency. Astronomers are anxiously watching how it will break up or disappear.

PROF. TICE ON THE METEORS OF NOVEMBER 13, 1879.

We are permitted to publish the following letter from Prof. Tice to a gentleman of this city explaining the absence of meteors in this locality on the evening for which they were predicted.—ED.

LE GRAND, IOWA, November 24, 1879.

MR. H. F. BUNGARDT, Dear Sir: Yours of 14th, forwarded to me at this place, just received. There are perhaps seven or at least six fixed periodic showers of meteors. Namely: April 20th to 25th, August 10th to 17th, Nov. 6th, to Nov. 12th, Nov. 13th, Nov. 27th and Dec. 6th to 9th. Of these that of the 13th of November is generally the most brilliant and of shortest duration, being only seen between 1 and 5:30 a. m., while the other displays are visible nearly if not quite all night.

I have examined all meteoric showers recorded in history, or the legends of them delivered by tradition for the last 3700 years, and I have not found one that is not comparatively local, covering not more than twenty degrees of longitude, but ninety or more degrees of latitude, as they have been seen from Gréenland on the north to Rio Janeiro on the south. The *Chicago Times* of the 21st instant

states that "parties in Indiana declare that there was a good display between 3:30 and 5:30 in the morning of the 13th. Prof. Dawson, the self-educated astronomer of Spiceland, saw quite a number, and the principal of the High School at Washington counted one hundred and ninety of them."

Assuming that the average breadth of the shower east and west is twenty degrees, our chance of seeing them is only one in nine, though there always is a sporadic distribution of broader extent. Those seen in Indiana and elsewhere in this country no doubt were sporadic, and the shower occurred elsewhere, probably in the Pacific Ocean. As those that occurred forty-six years before 1833, namely, in 1787, occurred in Eastern Europe, extending westward to Central Germany, and those in 1833 from the east coast to the center of North America, the shower this year may have occurred as much westward, say over the Pacific Ocean. I have hopes that they will yet be heard from.

As to my theory as to the cause of these meteors, it was arrived at inductively. Making allowances for the sun's translation through space, it will be found that the showers occur at the nodes of the planets, that is, where their orbits intersect the orbit of the earth. The solar apex or the point whither the sun, with his companions—the planets, is flying, is somewhere between 237° and 260° heliocentric longitude. Hence the earth may intersect both the ascending and descending nodes of all the interior planets and the descending nodes at least of Mars and those of the planetoids. The nodes of Jupiter, Saturn, Uranus and Neptune are probably too remote from the solar apex.

The meteors of April 20th to 25th occur at the descending node of Mars. The orbit of the earth where she is in August, is intersected by a very large number of the planetoids. The meteors of 6th to 12th of November occur at the descending node of Venus, those of the 13th at the ascending node of Mercury, those of 27th at his descending node, and those of December 6th to 9th at the ascending node of Venus.

It should be stated likewise, that the earth crosses her own orbit about the 25th of November, and this may be the cause of the meteoric shower from the 24th to 28th.

The Zodiacal Light seen in the east before sunrise until the 20th of November, after the 28th appears in the west after sunset. I hold that the luminous section of an arc known as the Zodiacal Light, is the path of the earth's orbit through space, marked by the gases left in her track. These gases may cause the meteors at this date.

Astronomers both in America and Europe are confident that a meteoric shower will occur about the 27th, I, however, think it very doubtful. Their theory is based upon the assumption that a comet that disappeared nearly thirty years ago lost its tail, and that this tail is still wandering through space to find the body. Hence it pursues the path the body would have done had it persisted. We have heard of and seen comets without tails, but no tail without a comet has yet been seen. In fact, the tail, it is well known, only develops and enlarges

until the comet has passed its perihelion, when it rapidly decreases and entirely disappears long before the comet itself does, in the far off realms of space. It is the same phenomenon as the tide on the far side of the earth when the sun and moon are in conjunction. That is, it is the effect of electric repulsion. That this is the case is evident from the fact that the tail of a comet always projects on the side away from the sun. For this reason I take no stock in comet tails without bodys, as causes of meteors. A great many of the meteors recorded in history have neither day nor month named when they occurred, and even the years named for the occurrence of what is unquestionably the same phenomenon, vary from one to four years. The monks, to whom we are indebted for many of the facts, regarded them as portends, hence, years after, altered the dates so as to coincide with some important, event, disastrous or otherwise, in the history of their country. It is only by the synchronous records of the Arabians or Saracens who then occupied Spain, that the true dates can be ascertained. For this reason it is difficult to verify the theory I propose, as accounting for the phenomena. For the November 13th meteors, when the true dates were ascertained after adding eleven days for difference in style, and allowing for the precession of the equinoxes, to ascertain whether they occurred on November 13th, I found some twelve that verified the theory that they were caused by Mercury. I found that in 1833 Mercury passed the ascending node the last time before the occurrence of the meteors on September 8th. Hence, subtracting any year from 1833, and dividing the difference by .24084225, (which, if I remember correctly, is the length of the Mercurial year), I found that Mercury passed the ascending node in the meteoric year within a few hours—sometimes only minutes—as he did in 1833. As Mercury did so this year, I hence inferred that the meteoric shower would manifest itself on the 13th of November.

I found also a large number of verifications as regards the December meteors, and I found that it requires Venus to pass the ascending node on November 8th. As she did so this year I expect a meteoric display on the night of either December 6th, 7th, or 8th. These meteors, if sporadic, are seen all night.

The velocity of the sun through space is not known. Hence, if the theory should be verified we will know that in sixty-five days he passes over a distance equal to the distance between the orbits of the earth and Mercury; and so likewise in regard to Venus. The importance of this knowledge to astronomy can not be estimated.

Yours truly,

JOHN H. TICE.

The comprehensive plan of the geological and economic survey of the Territories, prepared by Director Clarence King, and submitted to the Secretary of the Interior, has received his approval and will be submitted to Congress for the necessary appropriations to carry it out.

ORNITHOLOGY.

THE PECULIARITIES OF MISSOURI ORNITHOLOGY.

NARRATIVE OF AN EXCURSION TO THE GRAND PASS LAKES.

BY ERMINE CASE, JR.

(*Extracts.*)

It was an ideal day of Indian summer, the air thick with sunshine, a golden haze veiling all unsightliness and at the same time blending the brilliant colors dashed profusely over the woods; a thicket of sumac, like a great splash of raspberry juice along the hill-side. Even the turbid Missouri, with its bars, snags and cottonwoods, so aggressively ugly, had taken on the sheen of the glorious October afternoon.

A large skiff was floating down the swift current of that huge ditch, about midway the great state of Missouri. Its crew of three, otherwise drifting idly, were closely scanning the south bank of the stream. The craft was well loaded with boxes, bales, tent, guns, tackle and other paraphernalia of a thoroughly equipped hunting party.

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Meanwhile the wounded duck had raised himself straight up, at least two hundred feet without going forward a yard, and now, with lessening strength, began to sink, and with even motion came fluttering slowly down to the water and sat dazed and dying, only a rod from the boat. I had watched this singular maneuver, with intense interest, and the cool manner too with which my friend awaited the prophesied result. As we approached I could not but observe the extreme brilliance of the plumage of our game, heightened by the declining rays of the afternoon sun. It had every hue; but why mention blue, black, purple, green and white, when all those flat colors were blended, shaded and lit up by the most transcendent iridescence, playing over crest, band, bar and mottle.

"Charlie, what is that wonderful bird?" I asked in a maze of admiration.

"The drake of the wood duck. I believe there is no parallel to its beauty in any bird in any land."

"Why *wood* duck?"

"Well, they live along narrow creeks and wooded sloughs, they are fond of acorns and other mast, wild grapes and berries. I once flushed a dozen of them from under a pigeon oak and killed two a half mile from water. You look skeptical, but it is a fact; and you will be more than satisfied when you come to taste their flavor obtained from these same wild fruits."

"Do you mean to say you think the flavor of game materially affected by their peculiar food?"

"Certainly I do; but especially is it true of ducks. In the south the mallards live in the swamps and eat snails, lizards, frogs and swamp vegetation. They return to us unfit for the table. In the north they feed on grain, wild rice and seeds. Consequently they come down to us in the fall season plump and solid. Your vaunted canvas back is only choice when feeding on wild celery in Delaware Bay or the Chesapeake."

"But to return to the wood duck. I have not told you all his arborescent habits. When in pursuit of hackberries and grapes he often perches in the trees. It not uncommonly builds its nest and raises its young in the tops of old tree stubs, and in the ends of hollow branches. I have not only seen this myself, but it is the common observation on the part of all hunters. The young are kicked out and then partly assisted to the ground on the back of the mother, as is the case with the young of scores of other birds."

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"Besides the capital duck shooting," said Charley, "we are in the best field for ornithological pastime that can be found in America. The lower Missouri valley is neutral ground in more than one respect. Here we have long summers, and hot enough, too; while in the winter season, owing to the open prairie country toward the north and west, we often have days worthy of the North Pole. Then the extremes of moisture and drouth are ours. In the spring months the rains are many and wet, while the rest of the year they come "only by fasting." The mingling of flora is equally peculiar, and if the gods do prosper, we will have such chats about them all as we used to have in the old days when we pored over Audubon and delved in the swamps with Wilson."

Off to the east stretched the two (Grand Pass) lakes, sleeping among their willows, cat-tails and pampas grass. And now, as the sun was setting, long lines of water fowl were seen constantly swinging down and settling among the frosted lily pads. But there was to be no shooting to-night, as Kimbrough had announced that he never began work until the camp was perfect.

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We turned in early on a cozy bed of straw and blankets, Charlie's last remark being, "Ben, we must be off to the lake for the morning flight by four. Have us a cup of strong black tea." I felt the old black man coil himself up at our feet, listened a moment to a far away tattle of gabbling mallards, and then fell into that absolute lapse which always receives the well fed, hard working lover of out door sports.

Bright awake at once is the camping sportsman. No yawning and stretching. A splash of hands and sluicing of face and neck in the cold running stream; then you are hungry. But black tea and crackers must do for this early bite, and we are off through the frosty grass, under the still shining stars, well wrapped in coats and capes, belts full of loaded shells, cold gun barrels tucked under arms, and Splash, the Spanish retriever, at our heels.

Skirting the margin of the lake for half a mile, we passed out on a narrow point which made into the lake, and was covered at its extremity with thick

clumps of wild rose bushes, ensconced ourselves between two of the thickest and awaited the dawn. White in the east, and the stars flickered out; then pink, followed by rose, and meanwhile the lake was becoming voluble. The low gabble of mallards arose from the reeds; a tattle of teal and widgeon among the lily-pads; then far off down the lake we heard the coarse call of the trumpeter swan, like a distant fog bell. Oh! then, such a weird, seraphic band, as a score of those magnificent birds rose, circling upward a thousand feet, where the first rays of the sun caught their angelic pinions, and bathed their pure white plumage in rose. Such another graceful sight I never expect to see. But here I was recalled by the loud "quack, quack," of a flock of mallards crashing up through the reeds with a clamor and splash that made the lake resound.

"Now," said Charley, "be ready; we will have some shooting." But I was too much interested in the awakening of this populous city to care for sport; so peering out through a port-hole in our brambly blind, I saw the welkin take life. A thousand noisy mallards rose with flap and splash and cry, red heads, whistlers, pin tails, widgeon, teal—in droves, flocks, pairs and alone. The valley was filled with their maze of swiftly crossing lines. Back and forth, circling, rising, sinking. "Bang! bang! and again bang! bang! With the thud of falling birds upon the water, the clatter and clamor of those escaping, the splash of the whimpering retriever, and Charley's cheery cry—"Fetch him, good dog! Get him, Splash! Good boy!" from bluff to bluff the echoes resounded. Then as I gazed the arena cleared and quieted. In twenty minutes the lake was as quiet as a park pond; and all the while my gun lay on my arm unloaded.

"Why, you haven't fired a shot, Ned."

"No, but I have seen a new and wondrous sight."

"So you have. I remember well the first time I saw such a rising. But I have become so accustomed to it that I did not think how it would amaze you."

"It has been worth the cost of the whole trip to see it. Such numbers, such variety!"

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As we lay on the sunny side of a knoll after breakfast, taking our smoke, I asked—

"Why Grand Pass Lakes, Charley?"

"Lakes, because they are small bodies of water surrounded by land. *Pass* Lakes, because yonder high bluff constitutes a narrow divide between the south bank of the lake and the north fork of the Lamine river, and along that strait road the Indian tribes used to pass on their annual visit to the post at St. Louis. *Grand* Pass Lakes, because the French are fond of the prefix. Throughout countries where they were the early settlers, you will find grand rivers, grand prairies, and grand hillocks by the score. The lakes are only four or five miles long and without beauty; are devoid of interest save as a famous resort for water-fowl, yet we can get some good bass and croppy if you choose to try the rod."

"Can we? We'll try, some afternoon; but just now I would like to hear

you lecture on some of these duck. What is that little fellow Ben is holding up yonder, with the bright green wing coverts?"

"That is a green winged teal. It does not differ from the blue winged in any important particular. There is a little difference in size, which is in favor of the blue winged. They are named from the blue and green coverts of the wing. The green has a crescent of white just in front of the wing, you see. Now here in this blue one it is absent. They are confined almost exclusively to North America, but range very widely over that. They are known familiarly from Alaska to the West Indies. They nest from the far north to sometimes as far south as this. They go and come with the seasons, a little earlier in autumn and a little later in spring than the mallards and other large ducks. There is no better table bird among the ducks. But perhaps the most noticeable feature of the teal, is its velocity of flight. It is believed by our best observers that in rapidity it exceeds all other birds. Any experienced wing shot will tell you the difference between stopping a teal going down wind on business, and any other known game bird. But I have one well defined instance of measurement. I once shot, here in the Missouri valley, a blue winged teal with wild rice in his crop. As near as I have been able to ascertain, wild rice does not grow nearer us than five hundred miles in a right line. Food does not remain undigested in the crop of a bird more than four hours; therefore, my skeptical friend, that particular teal made that long flight at the rate of one hundred and twenty-five miles an hour."

Here Charlie sprang to his feet, seized his gun, and ran out toward the edge of the timber at a furious pace, at the same time slipping in shells, which he took from his pocket. Stopping behind a large elm at the border of the open, he stood in readiness to shoot. Along the line of timber came sailing, on even wing, a dozen large birds, anon beating their short pinions rapidly and again soaring, after the manner of all grouse. In much less time than I have taken to write it, the flock were abreast the hunter, and at the quick repeated explosion of the double barrel, down plunged two, heavily, into the thick marsh grass.

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"I was not aware grouse were migratory. Surely the authorities do not give prominence to such a habit."

"No. Still it is a fact that throughout the region west of the Mississippi these birds regularly migrate. Ornithological writers give general statements. They cannot enlarge on the effect of varied climates and topography. Now, the grouse of Long Island and Martha's Vineyard have never been migratory. Nor have they on the small sheltered prairies of Indiana and Kentucky. But from Minnesota, Nebraska and Iowa, they are driven by the fierce sweeping winds, and pass on below us in thousands every autumn. They do not usually go below the southern line of Kansas and Missouri, and there they are no longer found in small coveys, but gather in enormous flocks and become a scourge to the cornfields. But, alas for civilization, they are not to be seen now as they were ten years ago. Each year their line of flight is farther west. Many are now found.

on the plains themselves, and there they have no cover but the short curling buffalo grass. I have no doubt this very lack of cover on the plains will finally prove their extinction. There are no tall grasses, no bushes and brambles. The eggs and the young are exposed to hawks, eagles, wolves and all the other little and great lovers of chicken.

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When we arose from the table and began our preparations for going to the lake, the great, fleecy flakes were floating softly down. The old flat was a heavy, cumbersome affair, but roomy and staunch. All the way, while Ben was laboriously pushing the slow craft over the rushes, we could see the advance guard of ducks coming down from the north and settling among the reeds. Long lines of geese passed high overhead, giving out their "Ha-unk, ha-unk." And that afternoon we saw a flock of brant—the "laughing goose"—make their strange, tumbling descent from the clouds. When we first heard their cries, they must have been a thousand feet straight up over the lake. They had stopped in their flight and were circling slowly, when the leading gander suddenly fell as though shot, except that he kept himself in hand, as it were. Headlong he plunged a distance of a hundred feet, when, with a swoop of the wings, he arrested his fall for an instant, and then again dropped. The remainder of the flock did the same, all at different times and independently, each one keeping up his loudest cachinating gabble. An odder sight than these great birds, tumbling over and over one another down through the thickly falling snow, could not well be found.

Momentarily the snow was thickening, as were also the ducks. Constant flocks were hurtling over us; hundreds rose from the sedge as we passed.

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"Duck shooting you have had enough of; the fishing is no more; but, as I see you have still some discrimination in the way of birds, I will show you, to-morrow, what a complete aviary this lake, with its surrounding fringe of timber and willowy islands, really is."

"Capital! You could not please me so well in any other way."

"If the day is mild, you will see something quite worth while. I know of no other region where the variety of aquatic and semi-aquatic birds is so great. Here they come from the far north and from the islands of the Gulf; the 'bay birds' of the Atlantic coast with the fowls of the great dry plains. This part of the Missouri valley is the only place I know which is the meeting ground of such widely diverse species."

"You said something about the causes the other day?"

"It is not very difficult to account for it. Here, as I told you, we have a long, hot summer. Here, too, owing to the open nature of the country, the winter storms drive down with bitter fury. For the same reasons, the flora of this valley partakes of two zones."

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I awoke the next morning with the feeling that some pleasant sound had

stolen in at my ears and around my brain. And so it was. Looking out through the open door of the tent, I saw a form of crimson, sparkling about on the branches of a hawthorn, and ever and anon came the clear, ringing, glorious whistle of the red-bird—the cardinal gros-beak. Charley was watching him, too.

"That fellow is not one of my varieties," said he. "You may hear him wake the morning anywhere, from Montana to Florida."

Reaching the water, Charley lugged a long crooked stick of a mast out of a hollow sycamore log, and, stepping it into its place in the old flat, unfurled a big "leg-of-mutton" sail, and, just as the sun capped the distant bluff, we were off on the circumnavigation of the Pass Lakes.

There will be no cumbersome descriptions of scenery wild, graceful and picturesque; for nothing of the kind was seen. But it was a soft, balmy morning, and the light breeze, which gently filled our sail, rolled up long winrows of fog and softly garnered them away into corners among the willows and cottonwoods on the shore. The clumsy bark moved slowly, and, leaving the management to Ben, Charley and I sat forward, on the look-out for the first of the list of birds.

Ah! right there, fifty feet in front of the boat, where nothing had been, where nothing came, sat, cool and calm, appearing as though he hadn't come there and wasn't going away, a large bird, with a javelin beak, a falchion eye, a head and neck of bluish green, throat-marks of clean-cut white, and thence down breast, wing and back mottled with seried lines of white dots upon iridescent black—the great northern diver, a loon. Without visible motive power, he kept before us. There is no bird more conscious of his power. Now take aim. You have the quickest fire-arm known—a central fire, detonating cartridge. The mark is large and close at hand. Ah! the space is vacant, and the conical ball is skipping off yonder over the lake! Up comes the loon, rises on very tip-toe, shakes his short wings, laughs his wild, mocking, discordant laugh, and sits again, calm and defiant.

"What is that lithe, graceful bird in gray, Charley—yonder, skimming over the lilies?"

"Oh, that little party with the forked tail—the one who is only fifteen hundred miles from home? That is an ocean swallow, one of the gull family. I see a half-dozen or so every year winging familiarly about our ponds."

So, sleepily the old scow moved up the narrow alleys between thick flags and reeds.

"Ben, put in at the first dry point you come to, and we will have breakfast. I do not approve of taking too much morning air *solus*."

And here a burst of song filled all the morning. Teetering on the feathery frond of a long reed, sat the songster. Loud and sweet rang his orison, and in it were mingled the peculiar tunes of a dozen birds.

"Yes," answered Charley to my inquiring look; "the southern mocking-bird. I never saw one a foot north of here, not even on the north side of the Missouri river. And do you note the perch he has selected? That pampas grass belongs to southern plains, and does not grow naturally above this latitude."

"And what, pray, is that long brown chap standing on the lily pad right below him?"

"Quite apropos indeed! and not to be seen here once in a season, either. 'This occasion only,' you know, for your benefit. A Carolina rail, forsooth."

"Yes; I see his long toes, hairy plumage and generous snout. That will do, now; let's go to breakfast."

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The scow moved on up the lake. White-faced gallinules and coots sported everywhere on the water; with all the little ducks, dippers, spoon-bills, teal and butter-ball. These were not rare. They may be seen on retired ponds in all parts of the country in their season. Yet it is pleasant on a sunny morning to sail slowly along the solitary aisles of such a lonely lake and absorb all the sights and sounds of nature. A red-winged starling swings on yonder reed; the bluest possible kingfisher stands immovable, with eye fixed on the water beneath the old jutting snag, his perch. Then across the whole foreground goes a grey projectile, straight, still, and swift as death. It *is* death—to the starling we saw just now. A screech of terror, a thud, and off goes the hawk with his dinner, which he will take forthwith on the summit of the dead plane-tree yonder.

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"Charley, what are those big black birds sitting on that low, sunken log?"

"Why, now you have a *rara avis* in reality. I have every reason to think they are the red-faced cormorant. I admit that only two or three well authenticated specimens are reported from North America; still I am sure these can be nothing else. I have seen them in the valley twice before."

Meanwhile he was making ready his rifle, and, as he closed, took careful aim and fired. The old ark was moving slowly, but enough to divert the ball, and the heavy, sluggish birds took to wing unharmed. They were bluish black in color, with a crimson fez over their faces like the turban of a turkey cock, a slight crest, and plumage richly irridescent. As they flapped off, a great blue heron was aroused from his siesta, and added his lank, awkward flight to the scene.

"Herons, mocking-birds and rail from the far south; swans, cormorants and loons from Alaska, and a gull from mid-ocean. Let's pass on to the next cage," I exclaimed in wonder.

"The bald eagles floating yonder are not rare, but picturesque. However, I have one remaining stranger I wish to introduce."

"Do you mean the tall party yonder in white, peeping over the black flags?"

"Oh, no!" answered Charley. "The white crane is not exactly a stranger, though not numerous. He makes a fine tableau there. Should be sketched in conventional form, with the black flags for contrast, for the frieze of a dining-room."

All this while the scow had been gliding down narrow aisles among the reeds, now rounding a willow island, and anon squeaking over the rushes or grounding on masses of lily-pads and water moss.

The evening before we enjoyed a gust of snow. To-day the air was as balmy and the sun as mellow as ever yellowed the olives of Sorrento. When almost at the foot of the lake, we slid out into open water shallowing out upon low sand-bars.

"Ah!" exclaimed my friend; "there are my final marvels. Here is the last cage in my aviary." And he pointed to some immense white objects, evidently birds, larger than swans; some moving slowly about in the shallows, others basking on the bar.

"Not geese, surely?" I inquired.

"No, nor swan."

"Nor cranes with their heads cut off?"

"Hardly. I guess they will develop heads as we move up."

And they did. One big fellow on the bar stretched forth his head, heavily laden with mandibles fifteen inches in length. Then he spread forth his broad pinions and rose slowly. He was now neither headless nor all white, for the extremities of the wings were jet black. An immense membranous sac at the throat settled the question.

"Pelicans!" I exclaimed. "Are we on the Congo, or among the South Sea Islands, Charley?"

"Only in Missouri—a missionary field, nevertheless."

The whole flock of some twenty had flown also; and Charley ordered the ark turned about, and the return trip began.

"Are those birds common about here?" I asked.

"By no means; though any one who goes poking his nose into solitary corners as often as I do, will see them frequently. While duck hunting up the river here once, some years ago, I saw twenty thousand of them fishing together in one pond."

"Twenty thousand pelicans? You must think I'm a—"

"Keep cool, my boy; I'm not going to tell you the story. I tried that once, and no one believed it."

* * * * * * * * * *

There was a low piece of spouty ground lying between the bluff and the lakes and while taking breakfast next morning in the door of the tent, I saw a large flock of small birds whirl round and drop into it.

"Jack snipe," said Charley. "They come south in the autumn in large flocks. That marsh will be full of them for a few hours, and then all will resume their migration together."

"Is it not very late in the season for snipe?"

"Not in this climate. I have seen them, and woodcock, too, as late as Thanksgiving day.

"We need a few of them, don't we, Ben?"

"Fine brile, sah."

And off we started. The soft tussocks were full of them, and the spaniel had barely passed the first line of bog when—"Skaip, skaip, skaip!"—up sprang a half dozen together and went twisting spirally off. Well, this was easier work, and I

forgot all about the teal in the pretty, open shooting at the long-bills. For forty minutes we hammered away with both guns, when the birds got sick of it and all whirled off together over the bluff to the southward. We delighted the old darkey's heart when we laid down thirty-one of the fat speckled beauties for his larder.

We had spread ourselves out upon the grass and again I was pumping Charley on our favorite topic—birds.

"Paradise of game birds, you say? Yes; but the roll is not called yet. I will agree to bag, before noon to-day, quail, curlew, plover and woodcock, with just a mite of a chance for a wild turkey and a ruffed grouse; but I am reserving them for another trip."

Just here we heard the distant whistle of a steamboat.

"There she blows!" shouted my friend, springing to his feet. "That is the Joe Kinney blowing for Malta Bend. We will just be able to unlimber here and get all our traps aboard when she comes up to the mouth of the creek."

At it we went, and a half hour later our little barge dropped away from the cozy camping ground, with everything snugly housed in their several cases.

The savage (perhaps it is the reverse of savage) is strong in some of us. The overhanging elm had become familiar, the glade and brook grown to be household spirits, and I left that camp of five days with sincere regret, thinking that possibly the accessories of comfort, style, fame and bread we struggle for so wearily in cities are, after all, only dungeons ingeniously fitted up by ourselves with high, thick walls and grated windows.

CHEMISTRY.

PURITY OF CITY WATERS.

FROM DATA FURNISHED BY WM. PAUL GERHARD, C. E., ST. LOUIS, MO.

EXAMINATION OF MISSISSIPPI RIVER WATER. BY WM. PAUL GERHARD, C. E., ST. LOUIS, MO.

Date.	Locality.	Chlorine.	Hardness of Water in Degrees. Clark's Scale.			Total Solids.
			Permanent.	Removable	Total.	
Oct. 7, 1878	Water taken from water pipe at City Hall	——	——	——	13	——
Oct. 17, 1878	do	——	——	——	12¾	——
Nov. 17, 1878	do	1.4	——	——	12¼	——
Nov. 23, 1878	do	1.3	——	——	12.1	25 grs
Nov. 30, 1878	do	1.3	3.75	——	——	
Dec. 18, 1878	do	1.3	3.50	10.00	13.50	
Apr. 26, 1879	do	0.8	——	——	——	
July 15, 1879	do	0.7	——	——	6.9	
July 29, 1879	do	——	——	——	6.9	
Aug. 16, 1879	do	0.55	——	——	——	

SANITARY EXAMINATION OF 12 WELLS.

SITUATED ON EAST AND WEST SIDE OF JACKSON ST., BETWEEN RUTGER AND SOULARD STS., ST. LOUIS, MO. BY WM. PAUL GERHARD, C. E.

No of S'mple	Location of Well.	Depth of Well. Feet.	Pump or draw well	Grs., Imp. Gal. Chlo-rine.	Hard-ness.	Organic Matter.
1	1436 Jackson St., in yard . .	about 30	Draw well	9.7	40	. . . . . .
2	1628 Jackson St., in yard . .	——	Pump	14.8	37.5	. . . . . .
3	1446 Jackson St., in yard . .	40–50	Draw well	13.0	42.5	. . . Present
4	1555 Jackson St., in yard . .	——	Pump	24.0	45.0	. . . Marked
5	1418 Jackson St., in yard . .	35–40	Draw well	13.8	42.5	. . . . . .
6	1609 Jackson St., in yard . .	30	Draw well	2.3	27.5	. . . . . .
7	1508 Jackson St., in yard . .	25–30	Draw well	9.0	34 5	. . . Present
8	1316 Jackson St., on sidewalk	——	Pump	14.0	40.0	Large amount
9	1445 Jackson St., in yard . .	——	Pump	13.2	47.5	. . . . . .
10	1549 Jackson St., in yard . .	30	Draw	17.0	47.5	. . . Present
11	1424 Jackson St., on sidewalk	——	Pump	7.0	30.0	. . . . . .
12	1621 Jackson St., in yard . .	20	Draw	37.0	60.0	Very large amt

RELATIVE PURITY OF CITY WATERS.

CITY.	Source of Supply and Name of Chemist.	Inorganic Matter.	Organic and Volatile Mat	Total Solids.
New York . .	Croton, (average, 13 weeks, 1867) C. F. Chandler	3.90	0 66	4.56
New York . .	Croton, (average, 3 months, 1868) do	3.31	1.14	4.45
New York . .	Croton, (average, 6 months, 1869) do	4.11	0.67	4.78
New York . .	Croton, (May 11, 1871) . . . . do	2.799	0.875	3.674
New York . .	Croton, av'ge, 5 mos. winter '71–'72 (E. Waller)	3.934	0.508	4.442
New York . .	Well, west of Central Park, (C. F. Chandler, . .	38.95	4.55	43.50
Brooklyn . .	Ridgewood, av'ge 3 mos. 1869 (C. F. Chandler)	3.37	0.59	3.92
Boston . . .	Cochituate, (E. N. Horsford)	2.40	0.71	3.11
Philadelphia.	Fairmount, Schuylkill, (E. N. Horsford) . . .	2.30	1.20	3.50
Philadelphia.	Delaware, (H. Wurtz)	2.93	0.55	3.48
Albany . . .	Hydrant, (E. N. Horsford)	8.47	2.31	10.78
Utica	Hydrant, (C. F. Chandler), ...	5.50	0.96	6.46
Troy	Hydrant, (W. Elderhorst)	6.09	1.34	7.43
Syracuse . .	New Reservoir, (C. F. Chandler	12.13	1.80	13.93
Cleveland . .	Lake Erie, (J. L. Cassels)	4.74	1.53	6.27
Chicago . . .	Lake Michigan, (J. V. Q. Blancq)	5.62	1.06	6.68
Rochester . .	Genesee River, (C. F. Chandler)	12.02	1.23	13.25
Schenectady	State Street Well, (C. F. Chandler)	46.88	2.33	49.21
Newark . . / Jersey City / Hoboken / Huds'n City	Passaic River, (E. N. Horsford)	4.58	2.86	7.44
Trenton . .	Delaware River, (H. Wurtz)	2.93	0.55	3.48
London, Eng.	Thames, (Dr. Letheby)	15.55	0.83	16.38
Paris, France,	Seine, above the city, (Bussey, Wurtz and Ville)	7.83	1.00	8.83
Amsterdam .	River Vecht	14.45	2.13	16.58

(Taken from C. F. Chandler's Report upon the Sanitary Chemistry of Waters, 1875.)

ANALYSES OF HUDSON AND CROTON RIVERS.

BY PROF. C. F. CHANDLER, PRESIDENT NEW YORK BOARD OF HEALTH.

	Grains per U. S. Gallon.	
	Hudson River.	Croton River.
Chloride of Sodium	0.361 grains	0.402 grains
Chloride of Magnesium	0.157 "	———
Sulphate of Potassa	0.076 "	0.179 "
Sulphate of Soda	———	0.260 "
Sulphate of Lime	0.980 "	0.158 "
Bicarbonate of Lime	4.165 "	2 670 "
Bicarbonate of Magnesia	1.397 "	1.913 "
Silica	0.408 "	0.621 "
Alumina and Oxide of Iron	0.070 "	a trace
Organic and volatile Matter	0.699 "	0.670 "
Total,	8,313 grains	6,873 grains
Hardness,	3°.35	2°.51

Taken from C. F. Chandler's Report on the Waters of the Hudson River, made to the Water Commissioners of the City of Albany, 1872.

MILWAUKEE WATER WORKS.

WATER FROM LAKE MICHIGAN CONTAINS IN 100,000 PARTS,

Constituents,	Lime	4.8 parts
	Magnesia	1.6 "
	Soda	0.2 "
	Silica	1.6 "
	Sulphuric Acid	0.5 "
	Chlorine	0.3 "
	Carbonic Acid	5.3 "
	Chloride of Sodium	0.6 "
	Sulphate of Lime	0.9 "
	Bicarbonate of Lime	7.9 "
	Bicarbonate of Magnesia	3.5 "

Taken from the First Annual Report of the Commission of Health of Milwaukee, 1879.

CHICAGO WATER SUPPLY.

Water from Lake Michigan, analyzed by Drs. Blaney and Mariner, holds in one U. S. Gallon, 58,318⅔ grains; Organic Matter, 1.2727; Mineral Water, 5.9593, based on the following constituents:

Sulphuric Acid	.3024
Sodium and Potassium	.1389
Chlorine	.2083
Silica	.3512
Lime	2.4796
Magnesia	.6789
Peroxide of Iron and Alumina and Phosphate	.0756
Carbonic Acid	2.5043

BOSTON WATER SUPPLY.

WATER FROM COCHITUATE LAKE.

Date.	Observer.	Parts pr 100,00			Grns. pr U.S.Gal		
		Inorganic.	Organic & Volatile.	Total.	Inorganic.	Organic & Volatile.	Total.
July 1. 1834	C. T. Jackson	——	——	6.00	——	——	3.50
May, 1837	A. A. Hayes	2 11	0.93	3.03	1.23	0.54	1.77
July, 15, 1845	B. Silliman, Jr.,	2.09	1.08	3.17	1.22	0.63	1.85
September 8, 1845	do	3.78	1.99	5.77	2.21	1.16	3.37
September 8, 1845	do	4.54	2.38	6.92	2.65	1.39	4.04
September, 1848	E. N. Horsford	2.90	2.45	5.35	1.69	1.43	3.12
December, 1854	C. T. Jackson	2.59	1.84	4.43	1.52	1.07	2.59
———	do	5.14	3.43	8.57	3.00	2.00	5.00
February, 1855	do	5.54	2.34	7.88	3.23	1.37	4.60
———	do	4.14	2.03	6.17	2.42	1.18	3.60
December, 1870	W. R. Nichols	3.08	1.12	4.20	1.80	0.65	2.45
———	J. Dana Hayes	4.06	1.42	5.48	2.37	0.83	3.20
October 1, 1872	S. P. Sharples	2.01	2.78	4.79	1.17	1.62	2.79
December, 1872	W. R. Nichols	3.00	2.30	5.30	1.75	1.34	3.09

Taken from Prof. Wm. Ripley Nichol's Report on Present condition of certain rivers in Massachusetts, together with considerations touching the water supply of towns.

BOSTON WATER SUPPLY.

COMPLETE ANALYSIS OF COCHITUATE WATER, BY PROF. WM. RIPLEY NICHOLS, JULY 4, 1873.

	Parts per 100,000.	Grains per U. S. Gallon.
Ammonia, free	0.0033	0.0019
Ammonia, albuminoid	0.0120	0.0070
Inorganic	2.84	1.66
Organic and volatile	2.80	1.63
Total dissolved matters	5.64	3.29
Chlorine	0.34	0.20
Sulphuric Acid	0.91	0 53
Silica	0.28	0.16
Alumina, Oxide of Iron (and trace of phosphoric acid,	0.85	0.50
Lime	0 42	0.25
Magnesia	0.06	0.03
Soda	0.17	0.10
Potash	0.25	0.15
Carbonic Acid	undeterm'd	———

Taken from Wm. Ripley Nichols' Report on Present Condition of Certain Rivers in Massachusetts.

EXAMINATION OF WELL AND CISTERN WATERS

AT COLUMBIA, MO., BY PROF. PAUL SCHWEITZER, UNIVERSITY OF MISSOURI.

WATER.	Grains per gallon of inorganic matter.	Grains per gallon organic matter.	100 c. c. water require c. c. permanganate.	Remarks.
Distilled water	....	Trace	1.5	
Rain water	....	Trace	2.8	
JUNE, 1879.				
Cistern near English building	2.5651	3.2710	9.0	
JULY, 1879.				
V. Barth, cistern, new,	14.4532	8.5374	12.0	
Mr. Loeb, cistern, new,			9.5	
Dr. Duncan, cistern, 1	4.2880	2.7654	3.0	
Dr. Duncan, cistern, 2	7.4367	3.1042	7.5	
Irvin Switzler, cistern	4.5162	3.9201	2.5	
G. M. McConaughey, cistern	7.0213	2.4312	6.0	
Mr. Loeb, well	27.9752	Trace	3.0	
Mr. Batterton, well	66.1723	Trace	2.5	(*)
Mr. McConaughey, well	46.5932	9.9685	8.6	
AUGUST, 1879.				
Mrs. Flood, cistern	4.8245	2.1037	2.5	
Mission School, cistern	3.6255	4.1142	2.5	
Ed. Stephens, addition, cistern	6.3187	1.4211	3.5	
Pres. Rogers, cistern	2.0214	4.6721	6.5	(†)
Dr. Garnett, cistern	2.3202	4.4313	5.5	
P. Schweitzer, cistern	2.4213	4.2132	3.5	
Mr. Allgaier cistern	3.7148	4.9782	4.0	
Prof. Ficklin, well	38.3573	Trace	2.5	
Mr. Scruggs, well	36.2542	Trace	1.5	
Pond, Anderson, H. & Co., mill	7.2139	4.6721	3.0	
Pond, University campus	11.3102	3.3201	3.0	
Pool, Dr. Duncan, cow lot	29.0135	12.4213	10.0	(†)
Pool, Broughton & Adams	31.8932	10.7532	10.0	
1875, Missouri River, Jefferson City	19.2900	1.6296		
1856, Missouri River, Carrollton	15.4870	0.8180		

(*) Contains Nitre. (†) Contains much Ammonia.

EXAMINATION OF RIVER, WELL AND CISTERN WATER OF KANSAS CITY, MISSOURI.

BY PROF. G. E. PATRICK, UNIVERSITY OF KANSAS.

LAWRENCE, KANSAS, October 25, 1879.

MR. THEO. CASE; *Dear Sir:*—The amount of water in your samples was not sufficient for analysis by the most approved and accurate method, (Wanklyn's) but sufficient to determine whether *good* or *bad*, and also to ascertain the relative

qualities. As to *Chlorides*—not in themselves injurious of course—but a sign of sewage contamination in cities where the drainage water of the soil does *not* contain them, your samples gave: No. 1, Kaw, considerable; No. 2, cistern, none; No. 3, well, considerable. Nos. 1 and 3 about the same amount. As there is so much salt in our waters I did not take these results as indicative of sewage impurity; still, to make the matter certain, I compared water taken from the river *above* Lawrence, with your sample, and found the same amount of chlorides.

As to Ammonia, itself not injurious, but indicative of decomposing animal or vegetable matter, but a trace was found in all three samples, more in one and three than in two, still not enough in any of them to condemn or even to render them suspicious.

As to Organic Matter, as indicated by the "permanganate method," the amount in all was small compared with that in many waters considered wholesome. The relative amounts were about as follows: No. 1. 3; No. 2, 1; No. 3, 1.5. The river water was much worse than the others, but by comparison with distilled water, I found it was not bad at all. As explained above I could not with the amount of water at hand, get at the absolute amount of organic matter. From this examination it seems that your water supply in Kansas City, except where contaminated by local impurities, is excellent. Respectfully,

G. E. Patrick.

BOOK NOTICES.

Challen's Alphabetical Record of New Books. Philadelphia, June to October, 1879. Howard Challen. $1.00.

To book buyers, editors and others interested in current literature, Challen's Record will be found of decided value. It is published quarterly and embraces complete lists of all new books, with names of authors and publishers. It is also supplied with blank leaves for receiving titles of books published between its issues, and other memoranda.

The Throat and the Voice. By J. Solis Cohen, M. D. Philadelphia, Lindsay & Blakiston; pp, 159, 12 mo. 50c.

This is Number V of the American Health Primers, edited by Prof. W. W. Keen, M. D., that are having such a run as popular and trusted hygienic guides. Prof. Cohen, from his position as lecturer upon the Diseases of the Throat and Chest, in Jefferson Medical College and upon Physiology and Hygiene of Voice in the National School of Elocution and Oratory, has a wider range of personal experience on the subject than most physicians, to which he is fortunately able to add what is equally essential in this instance, a facile pen. The topics treated,

among which are the general construction of the throat, care of the throat, diphtheria, croup, enlarged tonsils, foreign bodies in the throat and windpipe, catarrh, cultivation of the voice, acoustics of voice, defects of voice, &c., are handled skillfully, and the directions given are eminently practical and proper, though without entering upon the domain of the physician.

WINTER AND ITS DANGERS. By Hamilton Osgood, M. D. Philadelphia, Lindsay & Blakiston. pp. 160; 12 mo. 50c.

Equally appropriate with the above, is this little monogram by Dr. Osgood, one of the editors of that staunch old periodical, the *Boston Medical and Surgical Journal.* It makes its appearance just at the proper time to give its readers those warnings and instructions which are so important, no matter how frequently repeated, and which, if duly observed, will ward off so many of the ailments of winter. The titles of a few of the chapters will indicate the scope of the work: Dangers arising from errors of dress; inattention to pulmonary food; sedentary life and neglect of exercise; dangers of school life in winter; winter amusements, &c. Dr. Osgood writes plainly, insisting with Spencer, that "all breaches of the laws of health are physical sins," and deeming it his conscientious duty to "spare neither age nor sex" in discussing such sins.

THE WORKSHOP COMPANION. Industrial Publication Company, New York; pp. 164, 12 mo. Paper, 35c.

This is one of those *multum in parvo* books, in the collating and arrangement of which Prof. John Phin, C. E., so excels. There is probably not a single reader of this notice, that has not at some time or other felt the want of some item of information contained in it, and would gladly have given the price of the volume for one of the recipes. The book covers a very wide range of subjects, there being no less than ninety leading articles, some of which contain as many as sixty sub-headings. The pages are of good size and closely printed in very clear type, so that 164 of them contain an unusual amount of matter. The subjects are arranged alphabetically, the work thus forming an almost complete encyclopedia of practical every day information. Although entitled "The Workshop Companion," a brief examination will show any reader that he needs it, whether mechanic, professional man or housekeeper.

THE COSMOGONY OF LA PLACE. By Daniel Kirkwood, LL. D.

We have received from the distinguished author a copy, reprinted from the Translations of the American Philosophical Society, of his article entitled as above, the conclusions of which may be stated as follows: "1st. The hypothesis of La Place gives no explanation of the immense intervals between the planetary orbits. 2d. That apart from this objection, the periods required for the formation of planets from nebulous rings are greater than the probable age of the solar sys-

tem. 3d. That it fails to account for the origin of satellites. And 4th. That it is apparently incompatible with a known physical law. The conclusion seems inevitable that this celebrated hypothesis must be abandoned, or that its principal features must be essentially modified."

OTHER PUBLICATIONS RECEIVED.

PROCEEDINGS OF THE PHILADELPHIA ACADEMY OF NATURAL SCIENCES. Part II.

On the Fertilization of Yucca, by Prof. Thos. Meehan. On Sex in Castanea Americana, by same author. On the Law governing Sex in Plants, by the same author. How to study Phrenology, by H. S. Drayton, editor *Phrenological Journal*, (illustrated) S. R. Wells & Co., Publishers. The Quarterly Elocutionist, October, 1870, Mrs. Anna Randall Deihl, $1 00 per annum, Prospectus of the Manual Training School of Washington University, St. Louis, Mo. The Medical News and Abstract, January, 1880, edited by I. Minis Hayes, A. M., M. D., Henry C. Lea, Publisher, Monthly, $2 50 per annum. Report of Commissioner of Agriculture, 1878. American Bookseller Annual Illustrated Catalogue. The Blacksmith & Wheelright, N. Y. Monthly; $1.50.

NECROLOGY.

OBITUARY NOTICE OF THE LATE PROF. BENJAMIN F. MUDGE.

BY PROF. JOHN D. PARKER, KANSAS CITY, MISSOURI.

Prof. B. F. Mudge was born at Orrington, Maine, August 11, 1817. When two years old he removed with his father's family to Lynn, Massachusetts, which place numbered his ancestors among its first white settlers. His parents were eminent for their piety, charity and hospitality. They encouraged studious habits among their children, providing them with good reading and stimulating them to literary attainments and knowledge.

Three of Prof. Mudge's older brothers entered the Methodist Episcopal Conference, the oldest of whom died early in his ministry. The second was distinguished as a linguist, particularly in the Greek and Hebrew languages; the youngest, and only one now living, having won an enviable reputation as an author of historical Sunday-school books.

Prof. Mudge graduated at Wesleyan University at Middletown, Connecticut, in 1840, from which institution he received his degree of A.M. several years later. During his vacations and at odd moments, he diligently pursued his studies in

natural history, and, although two years after he graduated he entered the bar, yet he never relaxed his interest in them, and for many years the Lynn Natural History rooms contained a large cabinet of his collecting, which was afterward removed to Kansas.

After sixteen years practice of law, during which he attained a wide reputation for uprightness and fair dealing seldom deservedly received by lawyers, he removed to Cloverport, Kentucky, where he was connected with the Breckenridge Coal and Oil Company.

On the breaking out of the Rebellion he located in Kansas, a state he had been strongly interested in from its first beginnings. He located in Wyandotte county, and his natural love for geology soon becoming known, he frequently delivered lectures on his favorite study through the country. In 1864, although a comparative stranger in the state, he was requested to deliver a course of lectures before the Legislature, whereupon that body conferred upon him the office of State Geologist, an honor entirely unsought for, yet thoroughly enjoyed. While the state appropriation provided for this office but a short time, in reality he filled the office for life, for until the day of his death he constantly received specimens for examination directed simply to "Kansas State Geologist." No matter to what city they were directed, they seemed by common consent to be forwarded to Prof. Mudge; and many a little fortune has been saved to its owner from hazardous ventures for coal, lead or precious metals, by the truthful and always kindly advice from one who knew well how to read "sermons in stones."

In 1865 he was elected to fill the chair of Natural Sciences in the Kansas State Agricultural College, to which institution he donated his valuable collection of geological specimens, which, during eight years connection with the college, he very largely increased in numbers and value. It was during one of his summer vacations that he discovered *Icthyornis dispar*, a bird with bi-concave vertebræ and teeth—an anomaly to science. In severing his connection with the college, the students, deeply grieved at his departure, presented him with a valuable watch, which he always carried—an ever-loving reminder of the mutual affection between students and professor.

The last years of his life he spent chiefly in making collections for Prof. Marsh, of Yale College, and thus brought before the scientific world many new and rare discoveries in palæontology. In 1878 he was made a Fellow of the American Association for the Advancement of Science, a degree he highly valued.

On Friday evening, November 21, 1879, Prof. Mudge sat at home with his wife, reading the fifth act of Shakespeare's King Lear—the wail over the dead Cordelia—when, feeling a pressure in his head, he stepped out of the door to walk in the cool air. A few moments afterward his companion heard a groan, and hastened to his side, but found him unconscious from a stroke of apoplexy. A physician was hastily summoned, but, by a painless transit, the Professor almost immediately passed to his reward.

On Sunday, November 23, all Manhattan came to look upon his loved form. Scientific friends from various portions of the state and Missouri came to pay warm tributes of praise to the deceased scientist. To the bearers were added four of his scientific friends, Profs. Snow, Popenoe and Parker and Mr. Joseph Savage, all of whom have been intimately associated with Prof. Mudge in his scientific pursuits. The day was beautiful, and the scene, as the immense procession wound its slow and sad way up Cemetery Hill, will not soon be forgotten. And, as the sprigs of evergreen were thrown lovingly into his open grave, we looked forward to the time when he will possess that blessed immortality of which this is a beautiful emblem.

In the summer vacation of 1867, the writer first became personally acquainted with Prof. Mudge, when, by a special invitation, he spent three royal weeks at his home in Manhattan, the days being occupied with making collections in the vicinity of that place, and the nights, until a late hour, in discussing scientific subjects. During this visit was matured the plan for organizing the Kansas Natural History Society, which afterward grew into the Kansas Academy of Science. Of this organization Prof. Mudge was elected the first president, and was again president at the time of his death. During these twelve years he was unwearied in his labors, always cherishing plans for the development and growth of the Academy, whose success formed one of the most joyous experiences of his life. His papers are the results of his own observations and experiments, and are real and substantial contributions to knowledge. While professor at the Kansas Agricultural College, he spent his summer vacations in making collections on the plains to enlarge his cabinet, the richest and best in the West, and he would often enrich the private collections of his scientific friends with boxes of valuable specimens. While at Topeka at one time, his attention was elicited by seeing impressions on the flagging stones of the side-walks, and this led to the valuable discovery in science of the so-called bird-tracks of the Osage valley. He did much original work in science, and several species which he discovered bear his name.

Prof. Mudge was the prince of collectors in the West, and possessed all those qualities of body and mind which made him truly successful. As a platform lecturer on scientific subjects, he was a general favorite with all classes. In a graceful and easy manner his rich stores of scientific knowledge would flow forth in rich, spontaneous utterances, and he was able to throw a peculiar charm around the facts of science. The Kansas University has recently honored itself by placing him upon its corps of special lecturers. As a teacher he was revered and loved by his pupils. He was wholly absorbed in his college duties, and was the student's best friend. He opened doors in the temple of science, and inspired his pupils to enter in and explore for themselves. As a friend and companion he was always true and genial. His friendships were remarkably warm and lasting. He was greatly beloved by all his neighbors, and this is a very sure test of a good man. He possessed a native purity and refinement of soul, more akin to the re-

fined nature of woman, which never forsook him in his most social hours. He seemed to be born without fear, and his scientific friends relate instances in their western explorations, when he would lie down without the least fear and sleep until the morning, surrounded by hostile Indians. He possessed great simplicity of life, and always felt as if he was a young man. The benevolence of his nature was wonderful, and he was always giving public lectures without compensation and studying methods of conferring favors upon his friends. He feared God and loved righteousness, and those who knew him best believe that he possessed a deep religious nature.

As long as science has a name and place in the great central plains of the North American continent, Prof Mudge will not be forgotten as a scientific explorer and discoverer.

IN MEMORIAM.—PROF. B. F. MUDGE.

BY MRS. KATE R. HILL, MANHATTAN, KANSAS.

Ah! who thought of death that glorious night—
With its wondrous pictures of shadow and light—
When the eyes of the sentinel-stars looked down
With their smiles of peace o'er the happy town?
Or heard, o'er the murmurings the night breeze brings
From afar, the rustle of "the angel's" wings?
Or o'er the low sweet song that Nature hummeth,
Heard the cry of "Behold, the Bridegroom cometh?"
One last, faint sigh—poor humanity's moan—
And his soul passed out to the "Great Unknown."
Oh, the painless journey, with the goal safe gained!
Oh, the sudden glory, and the heav'n attained!
Yea, our souls stand still 'neath the heavy cross,
For the crown gleams athwart the measureless loss.

As "over the lines," on the swift wings of flame,
Sweeps this wave of grief—surging over his name—
Proud science shall bow in the dust her head
O'er her brave fallen son, aye, her mighty dead,
For her widening paths he reverently trod,
And the God of *Nature* was *Science's* God.

Patient, unselfish, yea, undefiled—
With the trusting heart of a little child—
His lore was the key that he gratefully took
To open the mysteries of "Nature's sealed book."

Oh, grand, rare soul! like entrance was given
The Kingdom of Nature and Kingdom of Heav'n.
Who knows—in those far-away "isles of the blest"—
But his soul marcheth on, in its tireless quest,
Through that mystic land ne'er by mortal explored;
Through the "many mansions" of Him he adored,
'Mid days filled with rapture and glad'ning surprise,
Is learning the wonderful lore of the skies?

Honor, hand in hand with her twin sister, Fame,
Wreathes all over with glory his pure, true name,
But Faith, Hope, and Love—while their quenchless tears fall—
Have written him "Brightest and dearest of all."

EDITORIAL NOTES.

THE November meeting of the Kansas City Academy of Science was very well attended, and the exercises were of an unusually interesting character, consisting of a paper upon "Personal Hygiene," by Prof. George Halley, M.D., which, being oral, cannot be published, as we would like, and another by Judge E.P. West, upon "A Buried Race in Kansas," which will be found in this number of the REVIEW.

A resolution of respect for the late Prof. Mudge was passed, and eulogistic remarks made by several members.

The December meeting, falling in the holidays, was omitted, and the next regular meeting will be held on the last Tuesday in January, 1880, at which time papers will be read by Messrs. Coddington and Gilham.

THE second lecture of the extra course before the Kansas City Academy of Science was delivered on Tuesday evening, December 16, by Prof. Geo. C. Swallow, of the Missouri University. It was a complete and forcible statement of the views of one of the most experienced geologists of the country upon the question of "Evolution and Creation," in which he asserted the truth of the Mosaic account and pointed out the weak points in the evolution theory.

The lecture was well received, and was regarded by the friends of the creation theory as perfectly convincing and satisfactory.

The next lecture of the course will be delivered by Prof. J. T. Lovewell, of Washburn College, Topeka, Kansas, in January, 1880.

WE are indebted to L. Traber, Esq., for photographs of numerous archæological specimens of rare interest, belonging to his brother in Cincinnati; also, to John P. Jones, Esq., of Keytesville, Missouri, and to Ivon D. Heath, of Wyandotte, Kansas, for lists of valuable and interesting archæological curiosities, collected by them respectively.

MR. J. W. NIER, United States engineer in charge of the government work on the Missouri River just above this city, reports that the work is standing well the test of endurance. The high water of last summer did not injure the mattress. Floating masses of ice have not done any harm to the work thus far. The cutting along the Clay county shore has been stopped, and the strong current of the river

is diverted from where it originally ran. The work done so far has been a complete success, but, unless additional appropriations are speedily made, spring freshets are liable to undo it all.

PROF. BELL announces that before many weeks a person in this country can converse with a person in England by telephone.

THE steamer City of Berlin, which recently arrived from Liverpool, was lighted successfully during her voyage, by electricity. Four lights were placed in the saloon and two in the steerage, each having a light power of 400 standard candles, the apparatus being driven by a small four-horse power engine.

THE severest storm ever known in the history of Colorado set in on the Western Range at noon, December 14, and raged until the morning of the of the 15th without cessation. All stages and teams from and to Leadville were snow-bound, and the loss of property and life is thought to be severe, owing to the intense cold, the thermometer indicating 40° below zero.

There has been a severe storm in the Red River of the North country, the thermometer falling very low. Reports at different points indicate 25° to 40° below zero. At this city the mercury has not been below —9°.

THE experiment of employing cats as substitutes for carrier pigeons has been tried in Belgium with very satisfactory results, and it is proposed to establish a regular cat line between Liege and the neighboring villages.

A COUNCIL BLUFFS dispatch says six cars of silk worm eggs, en route to France, were brought to that city on the regular Union Pacific passenger train on December 16, and sent east on a special train. The lot is valued at $6,000,000.

AN alchemist has actually waked up and stepped forth from the sixteenth century, and advertises in the New York *Herald* for a partner with capital to enable him to manufacture gold!

ST. ELMO'S FIRE.—During a thunder storm in August, a pine forest in the Jura was illuminated with a light resembling the phosphorescence of tropical seas.

IF Edison has, as now appears to be probable, finally succeeded in obtaining an effective, practicable and cheap electric light, he has accomplished one of the greatest scientific triumphs of this century, and one which will almost canonize his name forever. Prof. Sawyer, however, doubts his success.

WE have received from a reliable citizen of Seneca, Kansas, in reply to a letter of inquiry as to the facts of the reported tragical death of a resident of that county by being struck by a falling meteor, "No truth in that meteor story *as to this section*. It occurred in the east, and the article was reprinted in a local paper here without credit, which made it appear to have happened here."

PERIODICALS.

THREE good stories will be given in the next number of *Good Company*, as follows: A Basement Story, by Edward Eggleston; A Hard Bargain, by Horace E. Scudder; and The Mystery of Gilliflower Inn, by Lizzie W. Champney. A charming pastoral paper, *Acer Saccharinum*, in which the maple sugar season is invitingly anticipated, will appear. Another of Mr. Towle's enjoyable sketches will have a place, this one being about Bismarck; also, more Roman Mosaics. Sidney Lanier and Rose Terry Cooke will have contributions, and many other contributions will be given. The first four numbers of the present volume given, without extra charge, to new yearly subscribers who send before January 1.

THE *Atlantic Monthly* is to contain more good things than ever, and in more inviting form. Beginning with the January number, it is to be printed from larger type on a page considerably larger than the former, and will be increased to 144 pages.

A new serial story, by Mr. Howells, begins

in the January number, and will run through six months or more. This is probaby the most gratifying announcement that could be made to American magazine readers.

The fine life-size portrait of Dr. Holmes, which Messrs. Houghton, Osgood & Co. offer for a dollar to the subscribers for the *Atlantic*, can hardly fail to have a very large circulation; certainly not, if the American people remember how much the wise and witty "Autocrat of the Breakfast Table" has contributed to the brightest and best, and the most entertaining portion of American literature.

THE *American Naturalist*, edited by Profs. Packard and Cope, presents in its December issue the following contributed articles: Archæology of the Champlain Valley, by Geo. H. Perkins; The Origin of the Domestic Animals, by G. De Mortillet; Historical Sketch of the Science of Botany in North America from 1635 to 1840, by Frederick Brendel; On the Extinct American Rhinoceroses and their Allies, by E. D. Cope; a full digest of Recent Literature; also, general notes, carefully made up by the editors and their associates, on Botany, Zoölogy, Anthropology, Geology and Palæontology, Geography and Travels, and Microscopy.

THE *Engineering and Mining Journal* continues to be the best authority in the country upon mines and mining, besides furnishing spirited editorials on industrial and kindred topics, a valuable summary of current science, market reports on minerals, mining stocks, etc. etc.

THE *North American Review* grows in cosmopolitan interest and importance. In the January number M. Ferdinand de Lesseps examines the different schemes that have been proposed for the construction of a Ship Canal across the Isthmus of Darien, connecting the Atlantic and Pacific oceans. The second article is by Francis Parkman, who reviews the arguments adduced in favor of Woman Suffrage by five advocates of that measure in the November number of the *Review*. Mr. Froude, in the latter half of his article, Romanism and the Irish Race in the United States, recounts the history of English rule in Ireland. That history is, according to him, a succession of blunders on the part of the successive English governments. Henry James, Jr., contributes an article on the life and letters of the eminent French critic, Sainte-Beuve, one of the most interesting figures in the annals of literature. An article by Prof. Alexander Winchell, on The Metaphysics of Science, goes to demonstrate the existence of a realm of thought deeper than the data of physical science, and on which the principles of science are dependent for all their validity. Mr. Cuthbert Mills, in his closing paper on The Permanence of Political Forces, considers the question of the currency. The literary notices are by Richard Henry Stoddard, who reviews three volumes, viz: Arnold's Light of Asia, Dr. Joyce's Blanid, and Bayard Taylor's Poetical Works.

THE *Popular Science Monthly*, conducted by E. L. and W. J. Youmans, and published by D. Appleton & Co., 549 and 551 Broadway, New York, presents the following table of contents for January: The International Weather Service (illustrated), by Professor Thompson B. Maury; John Stuart Mill, V, by Alexander Bain, LL.D.; A Roguish Household Pet (illustrated), by Frank Buckland; On the Migrations of Races, by Friedrich Müller; Vaccination in New York, by R. Osgood Mason, M.D.; The Most Powerful Telescope in Existence, by E. Neison, F.R.A.S.; The Moral Sense in the Lower Animals, by W. Lauder Lindsay, F.R.S.E.; Middle-Age Spiritualism; History and Methods of Palæontological Discovery, II, by Prof. O. C. Marsh; Interoceanic Canal Routes (illustrted), by Charles de Fourcy, C.E.; Premature Burials, by G. Eric Mackay; Why do Springs and Wells Overflow? by Joseph J. Skinner, Ph. D.; Correspondence, Editor's Table, Literary Notices, Popular Miscellany, and Notes.

THE *American Journal of Science and Art* for December contains original articles upon Photographing the Spectra of the Stars and

Planets, by Henry Draper; Artificial Fertilization of Oyster Eggs, and Embryology of the American Oyster, by W. K. Brooks; Origin of the Loess, by G. C. Broadhead; Observations on the Planet Hersilia and Dido, by C. H. F. Peters; Triple Objectives, with Complete Color Correction, by C. S. Hastings; Geology of Virginia, by J. L. Campell; Character and Intensity of the Rays Emitted by Glowing Platinum, by E. L. Nichols; Recent Additions to the Marine Fauna of the Eastern Coast of North America, by A. E. Verrill; Geology of Galisteo Creek, New Mexico, by J. J. Stevenson; Geology of Catoosa County, Georgia, by A. W. Vogdes; New Jurassic Reptiles (Pl. 3), by O. C. Marsh. Also, summary of scientific intelligence on Chemistry and Physics, Geology and Natural History, Astronomy, miscellaneous scientific intelligence, and book notices.

PREMIUMS TO SUBSCRIBERS.

We have determined to continue the plan which proved so appropriate and acceptable for giving premiums to our subscribers last year, viz:

To any person who sends us $3.50 we will send the REVIEW for one year, and any $1.50 book published by D. Appleton & Co., S. C. Griggs & Co., Robert Clarke & Co., Houghton, Osgood & Co., Roberts Brothers, J. B. Lippincott & Co., John Wiley & Sons, Henry C. Lea, S. R. Wells & Co., or Ivison, Blakeman, Taylor & Co.

To any one sending us $3.75, we will send the REVIEW for one year and any $2.00 book published by any of the above firms.

Persons desiring to subscribe for the Review and purchase any book or books, *or subscribe for any other periodicals*, published or obtainable in this country, can obtain special rates by applying to the editor in person or by letter.

Clubs desirous of subscribing for the REVIEW can have the same privilege as single individuals, besides the advantage of reduced rates of subscription.

To persons wishing to purchase law, medical, scientific or miscellaneous books, and at the same time subscribe for a periodical which includes within its scope popular articles upon all branches of science, mechanic arts and literature, we deem this a particularly favorable offer.

BACK NUMBERS.—To any subscriber for the third year we will furnish the back numbers of the first and second year for $2.25 each set, ound, or $1.75 each unbound.

TESTIMONIALS.

As the third volume of the REVIEW will close soon, and we shall be asking our friends to renew their subscriptions, it may be well enough, by way of showing the estimation in which it is held among scientific men and periodicals in different parts of the country, to publish extracts from some of the encouraging letters and notices we have received. From them it will be observed that the REVIEW has met with favor not less in the East than in the West, and that even in Europe it has found some readers of note who have been kind enough to express their appreciation of it and its management:

University of Kansas, Chancellor's Office.
Lawrence, Kansas, March 31, 1879.

* * * * * * *

I take this opportunity also to commend the REVIEW. The last number is especially rich. Count me among the paying subscribers, as per inclosed $2.50. Yours,

JAS. MARVIN.

University of the State of Missouri,
Columbus, Mo., May 13, 1879.

THEO. S. CASE, Esq.,

My Dear Sir: I can but congratulate you on the excellence of your journal, and I will try to aid you with an occasional article.

* * * * * * *

Yours truly,
G. C. SWALLOW,

Academy Natural Sciences,
Philadelphia, Apr. 23, 1878.

I regret to-day that the March number of your valued journal has not been received at the academy. Will you have the goodness to supply a copy, that our set may be kept complete? Yours truly.

EDW. J. NOLAN, Sec'y.

Prof. E. T. Nelson, Wesleyan University, Delaware, Ohio, writes Dec. 1, 1878, as follows:

"I have just read the November number of

your monthly with great pleasure and profit. I did not know that so interesting a journal was published in the West."

Prof. O. T. Mason, Columbian College, D. C., the distinguished American anthropologist, writes, Jan. 20, 1879:

"I have frequently promised myself the pleasure of showing my appreciation of your very creditable journal by sending you something from the foreign field, &c."

Hon. B. B. Cahoon, of Fredericktown, Mo., writes, January 30, 1879:

"I am much pleased with the REVIEW, and it is well worth the subscription price ($2.50), which I inclose to renew mine."

Boston Scientific Society,
January 31, 1879.

With thanks for kindness in sending your REVIEW to our Society, and congratulations upon the high standard it has reached, I am,

Ever yours,
J. RITCHIE, JR., Sec'y.

Philadelphia, Sept. 4, 1879.

DEAR SIR: In looking over our first volume of your journal I find we are wanting Nos. 2 and 5 to complete the same. Be kind enough to forward the above, as they will complete our set, which will be very desirable.

Yours respectfully,
E. HILTEBRAND,
Librarian Franklin Institute.

Osage City, Kansas, Sept. 9, 1879.

I am much pleased with the articles in the number before me, and I deem it a better work for the general reader than most of the scientific journals of the present day.

Yours &c., J. W. JACKSON.

Linton, Green Co., Indiana.
July 24, 1879.

* * * * * * *

I like the Review exceedingly well, and should it continue as interesting and valuable as at present I promise you a permanent subscription.

Very truly yours,
Dr. W. EDWIN GROUND.

St. Louis, Nov. 4, '78.

* * * * * * *

It will give me pleasure to do anything in my power to further your enterprise. Your journal is excellent and most creditable to yourself and the Great West, and much prized by

Your obedient servant,
A. J. CONANT.

New York, Oct. 8, 1879.

I have offered to send the REVIEW to the library of the Metropolitan Museum of Art, of which Gen. L. P. di Cesnola is director, as its archæological papers will there be appreciated, and would like, therefore, a full set from the commencement.

Very sincerely,
Dr. F. A. CASTLE.

Prof. Wm. Dawson, the noted Quaker Shoemaker Astronomer, writes:

* * * * * * *

"In one sense I seem to have reading matter enough without the REVIEW, but it is too good to be without."

Chemical Laboratory, Oberlin College,
Oberlin, Ohio, March 3, 1879.

I am under many obligations for your courtesy in the form of copies of the REVIEW, which I have read with interest. I have missed your journal from my table, and should like much to obtain the numbers from July to December, 1878.

Yours very truly,
WM. K. KEDZIE.

Topeka, March 29, 1878.

* * * The REVIEW is a very useful publication, and must contribute very sensibly to the material development of this section of the country, a record of whose history and development it is the object of this society to make up.

Yours very truly,
F. G. ADAMS,
Sec. Kansas State Hist. Society.

Washington, Jan. 20, 1879.

* * * * * * *

I look upon your REVIEW as a very valuable addition to scientific journalism, and one especially interesting to the growing West.

Very truly yours,
H. W. HOWGATE, U. S. A.

PROFESSOR WILLIAM H. WAHL, of Philadelphia, associate editor of the *Engineering and Mining News*, published in New York City, writes, August 5th, as follows: "* * * * I take much pleasure in reading your REVIEW, and trust that you are succeeding with it."

SMITHSONIAN INSTITUTION,
WASHINGTON, D. C., June 18, 1879.
EXTRACT.

* * * * * * *

Your REVIEW comes regularly and is always read with much interest.

Yours truly,
S. F. BAIRD, Sec'y.

THE KANSAS CITY REVIEW OF SCIENCE AND INDUSTRY, edited by T. S. Case, maintains the high character which was conspicuous in its beginning, for energy and thoroughness in a new department of Western literature.—*Phrenological Journal.*

KANSAS CITY REVIEW OF SCIENCE AND INDUSTRY.—We always hail the arrival of this excellent Magazine with genuine pleasure, for it always comes filled with a mass of reliable reading matter upon all important scientific and industrial topics of the day. Among the many contributors to the November number appear the names of Captain Howgate, the late Prof. B. F. Mudge, and Prof. F. E. Nipher. These are a few only of the contributors. Aside from contributions there is no publication of the kind that has as many and as ably written editorials. Col. Case is a gentleman of fine scientific attainments and one of the deepest students as well as a thorough pains taking writer. We hope to see the REVIEW receive, from the people of the West the support it so richly deserves. The price at which it is published ($2.50), places it within the reach of all.—*Western Homestead.*

WE congratulate the Kansas City REVIEW OF SCIENCE AND INDUSTRY on the rich variety presented in the July number. It is becoming one of the best as well as one of the cheapest of our scientific journals.—*Farm and Fireside, Springfield, Ohio.*

THE KANSAS CITY REVIEW OF SCIENCE AND INDUSTRY, Theo. S. Case, editor, comes to us filled, as usual, with valuable facts, well discussed theories, and useful suggestions. It speaks well for the intellectual growth of the country where such magazines flourish amid the hurry of the busy workers of the prairies of the west.—*The Daily Inter-Ocean.*

THE KANSAS CITY REVIEW OF SCIENCE AND INDUSTRY, published at Kansas City, Mo., comes to us full of reviews and interest. It has such a range of material that we are sure to find something in each one that is of interest to us. The general feature is of science as related to industrial pursuits, but it is also in other important topics creditably handled.
—*Boston Journal of Commerce.*

"A PROPHET is not without honor," etc., has many exemplifications, and one of the best illustrations is that people are prone to look at things at home in a careless light, because they are familiar with them. And we have a case in point in our Kansas City REVIEW OF SCIENCE AND INDUSTRY, and its contributors. For example, Dr. E. R. Heath, of Wyandotte, read a paper before the Academy of Science here, on "Peruvian Antiquities," to less than fifty people. It was published in the REVIEW, and created no particular notice. Yet the London *Quarterly Journal of Science*, the accredited organ of the scientific world of Great Britain, copies it in full as a valuable contribution to knowledge. Then there appeared in the REVIEW a paper entitled "Some Peculiarities of Our Ornithology," from the pen of Ermine Case, Jr., and it has been printed, with high praise, in the London *Scientific and Literary Review*. The *Journal* spoke of it at the time as one of the most interesting chapters in natural history, and we are glad to see it honored in such high quarters. The two events are quite a feature in the cap of the Academy, the REVIEW, and, above all, the writers respectively.—*Kansas City Journal.*

THE bound volume of the REVIEW comprises nearly 800 pages of well printed, substantial and reliable reading matter, comprising original articles by more than thirty able writers, and selected articles from a list of more than fifty of the best scientific, medical, educational, agricultural and literary periodicals in the world. The REVIEW has been warmly welcomed and many of its articles copied by the press of this country and England, both scientific and literary, and has

attained a regular subscription list very flattering to the first publication of the kind which has ever been established in the West. Col. Case has proved himself admirably fitted to conduct such a magazine, and we look to see it grow and flourish vigorously under his capable management.—*Kansas City Times.*

THE articles in the Kansas City REVIEW OF SCIENCE AND INDUSTRY are by the best writers, and contain much of interest to the philosophical and industrial world. This serial only requires to be known to have a wide circulation, and should be read by every intelligent and educated person. We heartily recommend it to our readers.—*Exporter and Importer.*

WE have upon our table the January number of the REVIEW OF SCIENCE AND INDUSTRY, edited by Theo. S. Case and published at Kansas City. As it purports to be, it is a magazine of science and industry, and is without an equal in the West. The names of some of the leading scientists and educators of the day grace its pages as contributors. It is an epitome of western progress, and is destined to become, in the near future, to the West what the *Popular Science Monthly* is to the East.

—*Normal Courier.*

WE are in receipt of the February number of the Kansas City REVIEW OF SCIENCE AND INDUSTRY, published at Kansas City, Mo., at $2.50 per annum. This monthly is one that has, in spite of all obstacles, attained a recognized place in American literature, and presents an array of scientific articles highly creditable to Western authors. The number before us is the second number of the third volume, and is one of more than ordinary literary value.—*The New West.*

THIS excellent magazine, the Kansas City REVIEW OF SCIENCE AND INDUSTRY, now in its third volume, comes to us each month replete with the latest and best thought on scientific matters. Purely a western enterprise, it is a fitting reflex of the intelligence and genius of the empire that is so rapidly building up in this Mississippi valley.

—*Chronoscope.*

WE are glad to note the success that Col. Case is meeting with in the publication of his REVIEW OF SCIENCE AND INDUSTRY. It takes an uncommonly good thing, such as the REVIEW is, to gain the support of a people who are as deeply immersed in business as those of the West just now. It is as good as anything of the kind in the country, and very cheap at $2.50 per annum.—*North Topeka Times.*

THE KANSAS CITY REVIEW OF SCIENCE AND INDUSTRY is a magazine deserving the patronage of all the intelligent people of the West, being, as it is, the medium through which the best writers of the West give their discoveries and theories to the reading public. The November number, now before us, falls in no respect behind any similar periodical in the country.—*Brookfield Gazette.*

For Advertising Rates Address Theo. S. Case, Kansas City, Mo.

KANSAS CITY

REVIEW OF SCIENCE AND INDUSTRY,

A MONTHLY RECORD OF PROGRESS IN

SCIENCE, MECHANIC ARTS AND LITERATURE.

VOL. III. FEBRUARY, 1880. NO. 10.

METEOROLOGY.

THE INTERNATIONAL WEATHER SERVICE.

Under this title the "*Popular Science Monthly*" for January opens with an article by Prof. T. B. Maury. The subject discussed is one of great and general interest, affecting so intimately all classes of society, and bearing upon so many of the most popular questions of the day, that we present an epitome of the chief conclusions reached by this writer. Introducing the subject, he says:

"The exploration of the vast body of water which surrounds the land-masses of the globe has been, since the 16th century, rapidly prosecuted. Its configuration has been determined, its tides weighed, its gulf-streams and counter-currents gauged, and even its abyssal depths sounded and surveyed, until we can now hardly speak, save by poetic license, of "the dark, unfathomed caves of ocean." But the exploration of that other and almost boundless ocean of air which envelops the whole earth and whose winds sweep its surface, swaying the waters of the sea and affecting every form of terrestrial life, has progressed but slowly. The upper atmosphere is pierced by but few of the earth's mountain-peaks upon which meteorological stations can be efficiently maintained, while the spasmodic attempts at aëronautic investigation of the cloud-land, daring as they have been, have realized less knowledge of its currents than that which Columbus in his voyages of discovery acquired of the circulation of the equatorial waters. Even in the lower atmospheric strata, the different national bands of observers have been widely separated—here and there an ocean unsentineled rolling between them—so that their

collated reports conveyed no clearly connected account of the trans-continental movements of air; and it is to-day disputed by some that North American storms cross the Atlantic to Western Europe. But, worse than all else, the observations taken by the most painstaking and indefatigable observers were, until recently, systematically vitiated, not only by a lack of uniformity in the methods, but by the more fatal lack of uniformity in the hours of observation. What would be thought of a little army confronting immense odds, some of whose regiments had one plan of battle and some another, some asleep when others were engaged, but none acting simultaneously? Yet such is a fair representation of the world's observational force which was expected to attack the great problems of meteorology, as it was until less than a decade ago.

"In 1870 the United States entered the field of weather-research; and, for the first time in the history of meteorology, there was then established a broad system of simultaneous observations and simultaneous reports of the weather. These reports were immediately worked up and graphically embodied in the simultaneous weather-maps, issued thrice daily from the office of the Chief Signal Officer, U. S. A., General Albert J. Myer, whose original and announced plan was to observe the weather over the whole country "*at the same moment of actual* (not local) *time*," as was stated on every weather map. This conception aimed at the rescue of meteorological researches from that disorder and disconnectedness which had always characterized the observational work. The prime object was to gain a daily *conspectus* of the atmosphere over the country as it *actually* was, and as it would be seen if a *photographic* view of it, so to speak, could be taken. The simultaneous method, when announced, seemed so natural and simple that one might have wondered that any other was ever attempted. Observations called "synchronous" had been, indeed, before this time, energetically made in several countries; but the term "synchronous" was used to signify that every observer read off his instruments at given hours of his own *local* time, and not at the same moment of physical time. Etymologically there might be little or no difference between "synchronous" and "simultaneous," but, for all the purposes of atmospheric investigations over a vast territory like that of the United States, the practical difference was by no means insignificant. When observers, who on the old "synchronous" method reported the weather status each at the same hour of local time, were separated by hundreds of miles, their reports failed to represent the actual fluctuations of the atmosphere and the true bearings of its cyclonic and anti-cyclonic movements; so that, when the meteorologist came to compare and chart the combined data, they yielded necessarily a distorted or untrue picture of the ever restless aërial ocean. On the other hand, in the "*simultaneous*" method, since all the observers over the wide field of the research read their instruments at one and the same moment (7 A. M. Washington mean time), their reports, when charted, give a true and life-like representation of the physical phenomena as they actually coexisted and conspired. As on the screen of the artist's camera the sun instantly paints the true image of the human face before its expression can be

changed, so does the process of simultaneous obseivation seize and secure all the elements necessary to delineate the current physical features and conditions of the atmosphere, as existing at a *fixed* moment, before they can have time to undergo change. Simple as this expedient is, it is evidently the key to all effective research in a gaseous ocean whose currents and waves are ceaselessly rolling and rapidly altering their geographical bearings, even while the sun is quickly passing from one meridian to another. Were all the weather observers of the world to read off their instruments, as it were, by a given tick of one clock, their collective data would furnish materials for the most exact delineations of the complex atmospheric machinery which it is possible to obt in."

Such is the account given of the new method of "SIMULTANEOUS OBSERVATIONS," the importance of which, for all purposes of weather-study, and weather-prediction can hardly be over-estimated. By the old Smithsonian method of observations and by that of Professor Espy also, all the observers read their instruments, not at the same moment of actual time, but at that of *local* time: they could not, therefore, render simultaneous reports. And, as Prof. Maury says, "a weather map based on non-simultaneous reports, instead of faithfully mirroring the sky overhanging a continent, necessarily gives it rather a *wry* face."

ORIGIN OF THE WORLD-WIDE SYSTEM.

Coming now to the history of the International Weather Service, which is, strictly speaking, an extension of the United States weather system to the globe, the writer proceeds:

"In September, 1873, the International Meteorological Congress was convened at Vienna, to consider all the graver questions that were then agitating public and private investigators as to the progress of weather science. The Congress was composed of official representatives, charged with the meteorological duties pertaining to the researches of their respective governments. It was then proposed by the representative of the United States, General Myer, that '*it is desirable, with a view to their exchange, that at least one uniform observation, of such character as to be suited for the preparation of synoptic charts, be taken and recorded daily and simultaneously, at as many stations as practicable throughout the world.*' This proposition was unanimously concurred in, and its hearty adoption by the Congress, the members of which virtually legislated for the nations they represented, at once secured the extension of the American 'simultaneous' system (as inaugurated in 1870 for the United States) to the entire field of weather investigation then covered or yet to be covered by the observers of all the nations. Soon after the adoption of this proposition at Vienna, by the courteous coöperation of scientific men and the chiefs of meteorological weather bureaus of the different countries, records of uniform observations, taken daily and simultaneously with the observations taken over the United States and adjacent islands, were commenced, and since then have been exchanged in semi-monthly communications. These reports, steadily increasing, now cover the combined territorial extent of

Algiers, Australasia, Austria, Belgium, Central America, China, Denmark, France, Germany, Great Britain, Greece, Greenland, Iceland, India, Italy, Japan, Mexico, Morocco, the Netherlands, Norway, Portugal, Russia, Spain, Sweden, Switzerland, Tunis, Turkey, British North America, the United States, the Azores, Malta, Mauritius, the Sandwich Islands, South Africa, South America, and the West Indies, so far as they have been put under meteorological observation. On July 1, 1875, the daily issue of a printed bulletin, exhibiting these international simultaneous reports, was commenced at the Army Signal Office in Washington, and has since been maintained. A copy of this *International Bulletin* is furnished each coöperating observer. This publication combines, for the first time of which we have any record, the joint labors of the nations in a research of this kind for their mutual benefit. As the network of coöperating stations already spreads over so vast a proportion of the land-surface of the globe, there is needed only the more general coöperation of the naval and merchant fleets of the world to supply ample data for a comprehensive study of the atmosphere as a unit. This need is now growingly appreciated, and nine series of marine reports, each containing the simultaneous observations of a number of sea-going vessels, have been added to supplement the similar reports contributed by the land observers, swelling the total observational force to 500 laborers. The harvest of physical data already garnered by this force, and daily increasing, will be invaluable for all future weather investigations. As the Committee of the Scottish Meteorological Society recently said, 'this truly cosmopolitan work, which the United States are alone in a position to undertake, thanks to the liberality and enterprise of their government, will bring before us month by month the general circulation of the earth's atmosphere, and raise, if it does not satisfy, many inquiries lying at the very root of meteorology, and intimately affecting those atmospheric changes which meteorologists have been recording.'"

This great scheme had been, long before the Vienna Congress was convened, revolved by General Myer, who had broached it early in 1870, and repeatedly alluded to it in his subsequent official reports, as an object he was laboring to accomplish by connecting all weather bureaus "in a grand chain of interchanged international reports, destined with a higher civilization to bind together the signal-services of the world."

But the necessity for world-wide weather observations arises from the world-wide movements of the great aërial meteors, and from the intensity with which they act. This necessity is thus pointed out:

"The storms generated over the sea often push with resistless energy against the loftiest mountain walls, and, surmounting their acclivities, press on as if they had felt no retardation, to sweep across an entire continent, and then, untired, to take a fresh start on a long ocean voyage. In a rigid examination of the Signal Service data for a period of twenty-six months, twenty-eight storm-centers, it was found by Prof. Loomis, traveled eastward across the Rocky Mountains and reached the Mississippi Valley in unimpaired vigor, having scaled that imposing barrier,

10,000 feet high, as easily as the steamship on its rapid course overrides a wave. In discussing the two cyclones which visited the Bay of Bengal in October, 1876, Mr. Elliott, Meteorological Reporter to the Government of Bengal, incidentally gives us some idea of the cyclopean forces which are developed by such storms. The average 'daily evaporation,' registered by the Bengal instruments, in October, is '.2 inches.' The amount of heat absorbed by the conversion of this amount of water daily over so large an area as the Bay of Bengal is enormous. 'Roughly estimated,' says Mr. Elliott, 'it is equal to the continuous working power of 800,000 steam engines of 1,000 horse-power.' A simple calculation will show that it suffices to raise aloft over 45,000 cubic feet of water in twenty-four hours from *every square mile* of the bosom of the bay, and transport it to the clouds which overhang it.

"Phenomena such as we have just glanced at, by their immensity and by the intensity of the forces which resistlessly propel them across seas and continents, will forever defy adequate investigation, save by an army of observers, acting simultaneously, both on the ocean and on the land, whose outposts stretch from the rising to the setting sun, and from the equator to the polar circle. For, as another has so forcibly and felicitously said, 'the atmosphere, unlike the ocean, is undivided and uninterrupted, and every change of state, in any part of its expanse, sends forth a pulsation of energy which is speedily felt far and wide.' If the oracles of Him by whom are all things declare that he spreads 'the cloud of dew in the heat of harvest,' who 'gathereth the winds in his fists,' and once hushed the roar of the Galilean tempest, well may these wonders, ever fresh from his hand, enlist the earnest and inspiring study and observation of intelligent men everywhere."

THE WEATHER CHART OF A HEMISPHERE.

In the technical execution of this purely pioneer work, the first step was the construction of a daily weather map, embodying, in graphic form, all the weather observations "taken simultaneously" in the Northern Hemisphere. On the 1st of July, 1878, the Signal Service at Washington began the regular publication of a *Daily International Weather Map*, based upon the data of same date compiled in the daily published *International Bulletin*. Both of these publications are sent, without charge, to every observer who engages to take the daily simultaneous observations. Such a chart is without a precedent in the history of scientific investigation. As Prof. M. says, "it illustrates the coöperation, for a single purpose, of the civilized powers of the globe north of the equator, and brings the atmospheric phenomena over the whole field of the research, and in their true relations to each other, within the easy comprehension of the student's eye. As these charts in successive order are spread out day after day, the investigator has before him a vivid *panorama* of the physical forces in pictured action, so that he can readily trace their mutual dependence and interaction in the normal working of the ponderous, yet beautiful, atmospheric machinery."

The *International Weather Map* serves in meteorological research as Mercator's Projection (by which the earth's entire surface was presented in a single picture) did and does in geographical exploration. It offers the meteorologist every day a *bird's-eye* view of the aërial ocean as it was at the fixed moment of time when all the observatious embodied in it were taken over the globe.

THE PRACTICAL UTILITIES OF THE WORK

are numerous and varied. "One of the first practical applications of the international observations," says Prof. Maury, "will be realized in the elucidation and correction of the '*law of storms,*' and of the rules for the extrication of ships at sea from the storm-vortex. In the domain of nautical meteorology, this law and its applications to the handling of ships on the outer circles of revolving gales, is especially yet to be sifted in the light of the most exact *simultaneous* observations. The international weather charts, illustrating the exacter forms of marine storms, show us that they assume very eccentric shapes, and consequently develop variant wind systems. On the liquid expanse of the stormy North Atlantic, crowded with the steamers and sailing-ships of all nations, there exists the finest field for this

MANŒUVRING SHIPS ON THE EXTERIOR OF A CYCLONE.

The dotted lines, *Aa*, *Bb*, *Cc*, *Dd*, and *Ee*, show the paths of *escape* from dangerous positions; the large arrow, the storm's progressive direction; the small arrows, the cyclonic winds.

investigation to be found on the globe. When these vessels become "floating observatories," rendering up accounts of their daily simultaneous weather experience, it will be comparatively an easy matter to set forever at rest the yet disputed questions of the phenomena of cyclones, and to formulate rules for manœuvring ships so as to elude their crushing forces."

WESTERN METEOROLOGY.

Another application, more immediately interesting those living in the western and interior States of the Union, is thus stated:

"As we have already seen, so far as critical examination has been made of the Signal Service weather maps, more than one cyclone from the Pacific coast every month, on an average, overleaps the Rocky Mountains and travels eastward, reaching the Mississippi Valley and the Lakes, with its original (perhaps ocean-born) strength. The ocean is preëminently the birthplace and habitat of storms. Thence, when fully formed and densely stored with aqueous vapor—the fuel of the cyclonic engine—they assail the land-masses of the earth, and traverse them, unless, *in transitu*, they perish for want of water and return to their native element. This is no less true of the great ocean that washes our western shores, notwithstanding its name, than of the 'stormy Atlantic.' Uncomfortably near as the West Indian hurricanes approach our Atlantic seaboard, they affect but comparatively a small strip of the eastern half of the United States, and often give us a wide berth. But the storms which invade our Pacific seaboard, from southern California to the mouth of the Columbia River, exert or expend their full force within the national limits, and frequently cut their broad swaths entirely across the country. The golden key, therefore, to our continental meteorology is the adequate knowledge of the barometric depressions and associate 'waves of high pressure' which roll over the continent from the westward, and, in their progress, dominate the weather to the north of the thirty-fifth parallel."

"Off the California coast there exists, throughout the year, a permanent area or wave of high atmospheric pressure, or a vast "anti-cyclone"—the diameter of which is something like one thousand miles. The barometer in this area reads 30.20 inches (see chart, p. 309). From its northern and western slopes, westerly and northwesterly wind belts extend in an easterly direction across the Coast and Rocky Mountain ranges. The immense stationary anti-cyclone, from which flows off this broad belt of westerly winds, is probably due to the continental barrier arresting and accumulating the perennial equatorial current from the central zone of the Pacific Ocean; and has its counterpart in the similar area of high pressure lying in the Atlantic, off the coast of Spain and South of the Azores. The great "*highway*," therefore, along which the chief atmospheric currents move and introduce on our continent the storm-controlling and weather producing influences, begins on the Pacific coast and traverses the country from west to east. As the Atlantic dominates the weather of Europe lying on its eastern shores, so in the Pacific Ocean is the cyclopean workshop of the atmosphere, in which are produced and

whence are sent forth the meteors that perpetually travel over North America, and substantially mold its climate and weather. To cover the North Pacific, therefore, with a network of "floating observatories," contributing their "simultaneous weather reports" to the Signal Service Bureau, is one of the grand desiderata of American Meteorology. A ship at sea is one of the best of stations for a simultaneous meteorological system. The value of its records is enhanced by the considerable change of the ship's location occurring once every hour; and the law of self-interest at least should compel every shipowner and shipmaster to enlist in a joint observational work which inures to his own safety and lends a helping hand to every meteorologist. If the solar light of day comes first from the East, we may nevertheless predict that the flood of scientific light necessary to elucidate the still obscure phenomena of American, and especially Western meteorology, will break upon us from the great Western Ocean. "The *improvement*" in the national tri-daily "Indications," etc., of the Signal Service, which General Myer hopes for, as his oceanic simultaneous work "progresses," cannot be doubted."

ATLANTIC STORM TRACKS.

Similarly he shows how the international data, collected by the ships of every flag, are invaluable for discovering the normal or habitual tracks pursued by Atlantic storms, and thus how they affect European weather. The accompanying chart, which represents a section of the International chart of the ocean storm tracks for the Atlantic, in August last, will give the reader an idea of the work :

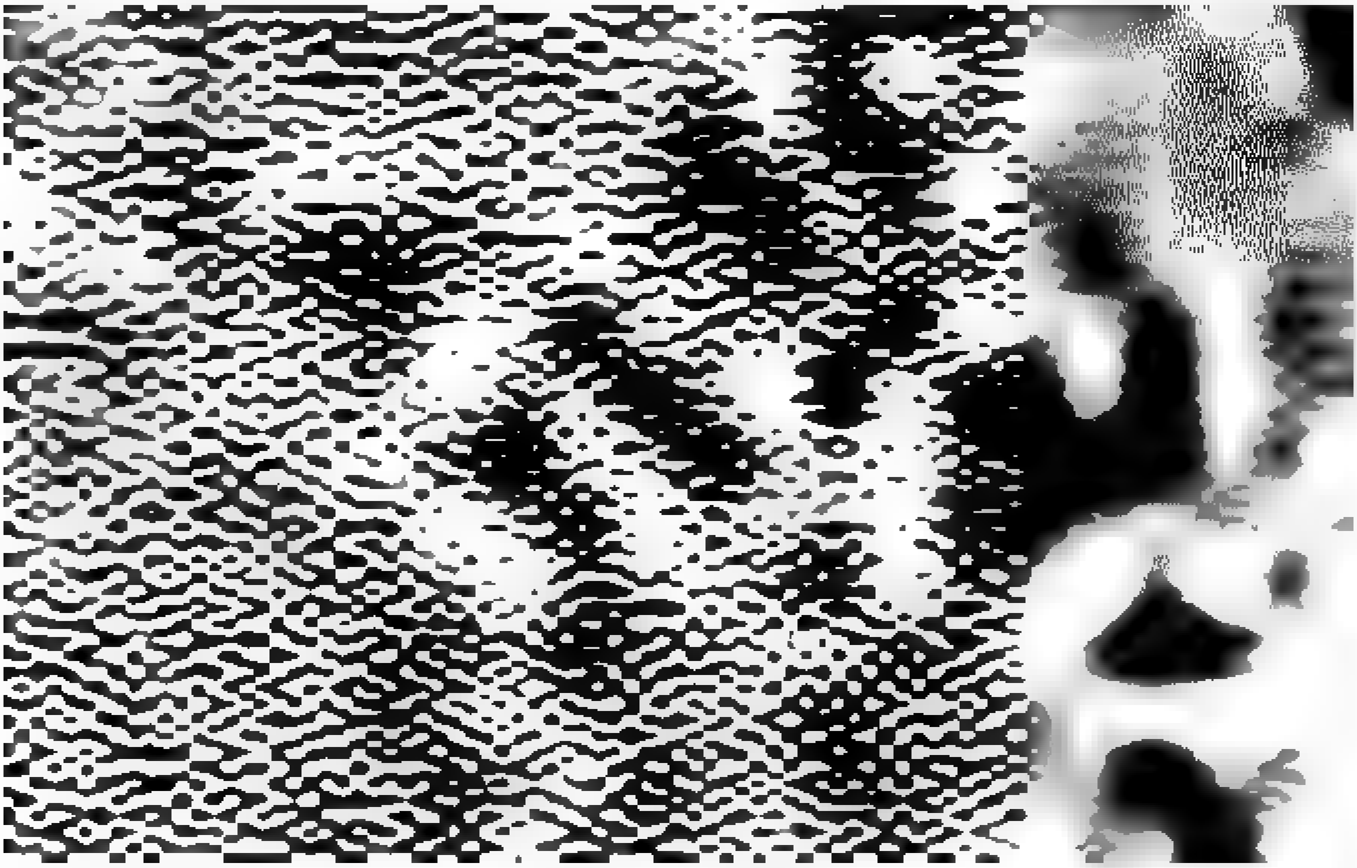

CHART OF OCEAN STORM-TRACKS BETWEEN AMERICA AND EUROPE.

[The dark lines show routes pursued by the August hurricanes; the numbers show the days of the month and locations of the storm center from day to day.]

The work of observing and charting the movements of ocean cyclones while crossing the Atlantic from the United States toward the British Isles, along the course of the Gulf Stream, is beautifully exhibited by the following chart, based on the international data:

AN ATLANTIC CYCLONE APPROACHING EUROPE, AS CHARTED FROM THE INTERNATIONAL WEATHER REPORTS.

(The circular area marked "LOWEST," shows the position of the storm vortex.)

The light afforded by such charts, on ocean meteorology, will gradually prepare meteorologists to anticipate the points on the British and French coasts, where American storms, in each season of the year, will strike. Thus, the data will prove of the highest utility to Europe as well as to America.

Again, the temperature and rainfall statistics gathered by the international corps of observers, have a most important bearing on all kinds of agriculture, and the writer shows how, had the international weather service been sufficiently extended last spring, the long wet season and cold summer of 1879, so disastrous to British crops, might have been predicted. "Ask," he says, "the British farmer what he would have freely paid in June to have gained some idea of the July weather. Or ask the English merchant what he would have given in June for a tolerably correct crop-forecast for the summer of 1879!"

THE CLOUDS.

Equally valuable in the every day life of the merchant and the farmer will the study of the cloud-phenomena over large regions of the land and sea be found.

"Take a single illustration of the utility which such rules would have for the farmer, the sailor, or any close observer of the sky. Our storm-centers are generally preceded by a great bank of those clouds to which the name cirro-stratus is given. They are composed largely of freezing or frozen vapor, floating at great elevations, and often very far in front of the depression and over the belt of country which is to receive its rainfall. They move in parallel lines and are distinguished by their thread like and attenuated delicacy, as well as by their altitude—from 20,000 to 40,000 feet—from all local clouds. Outlying streaks of the cirro-stratus, frequently visible from twenty to one hundred miles in advance of the main pack, "like pioneers of the coming army," can easily be detected. But the main body, since it forms the familiar *halo*, can not be overlooked. It is the timely omen of the impending disturbance, delivering its faithful warning long before the barometer begins to fall and tell its confirmatory tale.

"Could the rural populations and those whose occupation calls them much out of doors be assisted in interpreting these and similar phenomena, however untutored they might be in meteorologic terms and theories, they would soon learn to forecast many of the great weather changes for themselves. But as the storm-signaling clouds, conspicuous to all, fly aloft in those mighty "upper currents" which observation shows, attain not uncommonly velocities of one hundred and twenty and sometimes even one hundred and fifty miles an hour, none but *strictly* "*simultaneous*" weather reports can adequately or truthfully reflect their actual, ever-flitting movements as related to storm vortices and other atmospheric phenomena, whose approach they foretoken."

Finally, the future applicability of this vast and exact observational system to the work of forecasting the character of coming seasons is presented. That its extension will make this in a large measure practicable, Prof. Maury elaborately shows, and illustrates by reference to the abnormally warm autumn and low pressure of 1879, which, with stations in the far northwest and British America, reporting the barometric and thermometric conditions, could have been predicted. He concludes—

"Could the international system of reports have been extended to the upper valley of the Saskatchewan before the enormous barometric anomaly of last fall developed, the prevailing weather of last September and October could have been then measurably foreshadowed, with almost as much certainty as, when a "cold wave" from the north is moving over the lakes any day in January, the Signal Office indicates 'cold weather' for the interior of the country."

EVIDENCE FROM THE WEATHER MAP.

ISAAC P. NOYES, WASHINGTON, D. C.

Nothing could more conclusively prove a scientific statement than the weather for the past year has proved the correctness of the "New View of the Weather Question," published last year, in the July and August numbers of the KANSAS CITY REVIEW.

Here in the vicinity of Washnigton, we had a hot and dry summer. All through June and July and up to the middle of August we had very little rain—no regular storms—only a few showers of short duration. Vegetation was all drying up. The hay crop was only about one-half the average quantity. The grass all about, in the city and in the country, was brown and dead. There was no feed for the cattle excepting on the marshes near the river. The smaller springs and rivulets were so dry that it was with difficulty the farmers could get water for their stock; and as most of them could get no grass or feed for their cattle, they had begun to feed them on their winter's supply of hay and grain. The supply of vegetables was suffering severely for want of rain. The cry began to go round—"What shall we do for vegetables if it continues thus hot and dry? What shall we do with our stock?" Signs of rain appeared, but no rain came that amounted to anything against such protracted dryness.

All of a sudden, on the 15th of August, a change comes o'er the scene. On the morning of this day there is a marked change in the temperature, and it "feels" like rain, and all the "signs" seem as though they were genuine and would produce favorable results. Even the more inexperienced persons seemed to realize that "we are *now* going to have a storm"—and we had one. That afternoon it rained a little. The next day (the 16th), opened sultry and warm. The afternoon of this day we had more showers—it rained more and more. By early evening it was raining hard and rained all night. On the 17th we had heavy showers all day—raining most of the time. Large quantities of rain fell. It rained all night of the 17th and during the morning of the 18th. Toward noon of the 18th it held up and the heavy clouds began to pass over to the west, and by afternoon, about 4 p. m., the sun came out bright. We had had a fine storm and just what we needed—abundance of rain. The weather was much cooler and very pleasant. The next day we heard of severe storms at sea—all along the Atlantic coast to the north of Hatteras—with much destruction of property.

As there is a cause for everything, there is or was a cause for this sudden and agreeable change in the weather, and one that may easily be understood if we will only heed the knowledge that is so plainly spread out before us. But the world at large is loath or slow to look into things new, and they have little faith. They like to "wonder" what causes various effects in nature; and to many individuals there seems a greater charm in wondering and idealizing to no purpose on what causes these effects than in the practical investigation of them, whether it be

in regard to rain—too much or too little, or in regard to the wind—its direction, force and power to cause destruction, or some other subject quite foreign to this department.

As an illustration of this spirit, I quote from a popular writer—one who has superior advantages for acquiring knowledge, and who writes much on the various topics connected with natural phenomena, yet who refuses to make a proper study of the same in connection with the weather. "Whirlwind, tornado or cyclone, aerial or electrical, such visitations as that which has marked such destruction in Missouri, and was experienced in Connecticut last summer (1878), is equally inexplicable. It comes and goes "where it listeth," and man is powerless in its path. One feature of these exhibitions is the sharpness of the line between death and safety. Whether the width of the track be more or less, it is as sharply defined as the curbing of a city. An inch within the line and nothing can withstand the force of the elements. An inch without, and a baby's cradle will barely be rocked. Crude as have been the theories as to the cause or causes of these cyclones, they are not as much proved as they have been suggested; and if we knew all about them, there would be no possible mode of either preventing or escaping from them. Whither would we fly? Ordinarily the approach of a cyclone is indicated by a deadly stillness in and oppression of the air. There is no guide as to the direction it will take, and the first impulse to get out of doors may only expose one to death from unimpeded wind." * * * * * *

Now this, as a description, is very good, and there is much good comment; still, withal, there is throughout an ignorance of the weather system that is not justifiable in one who even in this short extract shows ability to grasp a subject so simple as the weather. But one great opposition that all things have to meet is that misapplied combative spirit that prompts many people to consider it an indication of greater wisdom to be sharp, to reject or oppose a newly revealed truth, than to accept it and combat earnestly for it.

These phenomena, such as the tornadoes that visited Kansas and Missouri and passed through Connecticut last year (1878), and the hot and dry spell this summer, up to the middle of August, and the sudden change that *reached Washington* on the 15th, and produced effects of storm, wind and destruction that were felt over at least one-half of the United States, *are not* "inexplicable." They are "unavoidable," and so are ten thousand other things in nature. But we have implanted within us a sense whereby we may explain many things that we cannot avoid. As every sensible person knows, there is a point beyond which we can not go; but because we cannot pass that unknown barrier in the weather question as well as in all others, it does not become sensible people to complain particularly of this branch of natural phenomena and to repeat their complaints and dolefully remark that "after all we don't know anything about this weather subject." To be consistent these people should show their want of faith in all branches of science; for certainly there is no subject that can be carried nearer to a first cause than this of the weather. There are certain facts in this department established

beyond doubt and controversy, facts that cannot be gainsayed by the most learned and combative opponent.

The great element that causes the change in the weather is the *area of low barometer.* This, like the sun and the planets, is all the while on the move, and like a great magnet causes the contraction of the air of the globe, as the magnet attracts the particles of iron; and essentially works on the same principle as a moving body of heat. Wherever it (*low*) is, the air is rarified and as naturally as water runs down hill the surrounding air rushes in and takes the place of the rarified air. The movement of the air brings along with it whatever is in its way, even as the Mississippi flood takes along with it whatever floatable gets into its mighty current.

Clouds are being formed everywhere and at all hours of the day. These, balloon-like, are likewise carried along with the majestic current of air toward the area of low barometer, and when these clouds become sufficiently concentrated in and about the area of low barometer, the same wind that has forced them on becomes the principal agent in causing them, by the process of squeezing, to precipitate the moisture again to the earth. The other and minor agent in causing this precipitation is the heat of the sun in its natural process of evaporation; and this will account for the higher strata of light clouds that move above the heavier strata below, and in quite a different direction from them.

Because we cannot avoid these things, or the reception of the *evil* effects from a storm as well as the good, it is no reason and does not become us to be satisfied with no knowledge of the storm, and to remain in ignorance of the beautiful laws that it obeys. Poor human nature is powerless to avoid many things detrimental to our interest and comfort (or what seems such), growing out of the workings of of nature. But this will never deter the wise from advancing as fast as it is possible for their faculties to lead them into the labyrinths of nature, whereby they may at least learn some points of the workings of Providence; and knowing these, have some little knowledge whereby they may understand how the effect is produced, if they have no power to control it or to trace it up to the full understanding of the Great First Cause in nature. The Great First Cause has been concealed from us for many ages, and this subject of the weather is not alone in not being advanced to a revelation of this great desire of the human mind. To trace it up to this point is all the human mind, in this sphere of existence at least, can expect or hope to attain unto.

To go back to the storm of the 15th of August, we seldom have a more marked exhibition of these meteorological changes. The changes which resulted in this storm were as marked as black against white; therefore making such a storm a fine instructive and positive illustration of the principles herein advocated. Prior to this day low barometer had been repeatedly traveling on a high line of latitude—about on a line between the United States and the Canadas, causing southerly winds which necessarily resulted in making it exceedingly hot all to the south of this line, and dry because the clouds that upheld the moisture were car-

ried beyond the lines that would affect all on the Washington line, or about 10° south of the center of this area of low barometer, or the storm center. For some reason, at present beyond the knowledge of man, the area of low barometer changed its course the next time, and instead of repeating itself in the Northwest, as it had done about all summer, started in the Southwest; so on the 15th of August, we in the Northern States had a sudden change of wind and consequently change in temperature, with good prospects of rain. In place of a south wind we had a north wind. Here in Washington it was almost cold enough for a fire. Later in the afternoon we had a little rain, which proved to be only the forerunner of a great storm. That night it was very cold for midsummer, the area of low barometer being to the south of us. The next day (16th,) here in Washington it was sultry and warm. Why this latter change? Simply because the very center of the area of low barometer was directly over and about us, and we again necessarily had the wind from the south. On the afternoon of this day (16th), it began to rain in heavy showers. These showers grew more and more frequent until toward evening it set in to one continuous and heavy rain, with a continuation of the warm temperature. Low barometer was passing over us still, to the Northeast. From the 17th to the 18th they got the storm up in New England. Some time during the morning of the 18th the area of low barometer passed off the coast, the *center* about on a line of 35 degrees, with lines reaching to the North, covering a good portion of New England. It continued to rain in Washington until about ten or eleven o'clock, but not very heavily. It was evident that the storm had spent its fury so far as this locality was concerned; but for localities further to the East and Northeast, they were just beginning to feel the results of the storm which were reported in the morning papers of the 19th of August as being very heavy, and the heaviest of the season.

We know the cause of low barometer on the land. By the aid of the telegraph it is easy to trace it; but its course on the ocean is yet unknown. Still, as remarked in the "New View of the Weather Question," it may be the reverse of what it is on land. I see no good reason why it should not travel after the same manner as on the land. Yet as illustrated not only in this storm but in many others, and in fact, almost always, the area of low barometer, when it passes off the coasts causes a northwest wind, proving either that the center of *low* must have passed to the southeast, else that another area of low barometer must almost always at the same time be in that locality (Devil's Corner), and of sufficient force to counteract the effect of the *low* that has immediately passed off the coast in our locality. We can not prove this, however, pro or con, until we can have some ocean stations, or till Congress will authorize a number of its idle naval vessels to be stationed along the coast, and to be in readiness and under the control of the Signal Office, to start at the proper time when a *low* is passing off the coast, and follow it up. Let not a hasty judgment be formed on one trial; but let it be re-repeated a number of times. For only by some such means can we hope at present to practically solve this question as to the direction of *low* along our coast.

This, as a scientific question, is well worth the trifling additional expense that it would cost the Naval Department to accomplish. Money expended in the interest of science is a gain and not a loss. It is a benefit to mankind, and one I think that the public would, on a full understanding, appreciate and endorse. It is well to move slowly in such matters; yet it is not well to retard the accumulation of wisdom, for thereby we only rob ourselyes.

Phrenologically speaking "continuity" is large in the human race. We see evidence of this when any new idea is advanced, at least any idea that does not promise an immediate and profitable financial return. Yet many ideas, and perhaps most of the ideas that the world is slow to accept, are really of far more value even financially, than others that externally seem to be what are called good investments, and which the world are so eager to grasp. In many things the world is exceedingly short sighted. There is too little faith in the great moral principle embodied in that phrase "cast thy bread upon the waters for thou shalt find it after many days."

We want more "long headedness," more faith in what is right and true, and in those great principles that are of far more real value to the world than mines of gold and silver. In this subject of the weather there is much satisfaction and practical benefit. It should be more universally studied. Then it will be more easily understood. Every college in the land should take and peruse the weather-map as regularly as a well-to-do citizen takes the daily paper. This done, and in a short time the spirit of the weather question will reveal itself to the intelligence of the world, and through this grand power raise the weather question to an honored rank with the other noble arts and sciences of the earth.

The next area of low barometer that was developed in the West started on a higher latitude, the natural result of which was a return of hot weather, though not so hot as prior to the 15th of August, for three reasons: first, the area was not on so high a line of latitude; second, it having been cold, it necessarily took some time to heat up again; third, the sun was daily getting further and further to the south, therefore making it generally cooler at the north.

This fact of a return of LOW to a higher line of latitude, and the results therefrom, is simply noted here as a proof that LOW, as an agent or sub-power of the sun, was the controlling element in the case.

All science has its exceptions, or what appear to be such; so we have the saying that "exceptions prove the rule." What may be termed "exceptions" are simply the predominance of the stronger element. Nature is not so evenly balanced in any department as to have one train of results follow another like clockwork. There is always a struggle. That force which is strongest for the time being will prevail, whether it be heat or cold, or the advantageous position or relation of chemical attribute—a simple predominance of some element in the scale, so far as our faculties are concerned, making quite another whole out of the same parts. Why this is so, is a mystery to us—one of the mysteries to be solved in the ages to come—and only by analogy, it would seem, could we get a clue to the

unraveling of this mystery of nature. But for this element—*the predominance of the strongest force*—which may be termed a law in meteorology as well as in other things, we would not have the variety that is so often experienced. We would tire of a monotony, or be so affected by its results as ourselves to become monotonous beings and unable to cope with any of the untoward and trying circumstances that are so common in our every-day life. Nature, by her changes, her exceptions, drills us in a school that harmonizes with all her action,, and thereby prevents us from falling into any sluggish ways. She thereby sharpens our faculties and prepares us for higher and higher attainments. To ever be prepared for the "exceptions," should be one of our guiding rules through life.

About two months later (than the 15th of August), we had a change of quite a different character. Sunday, October 19, 1879, we had another remarkable change in the weather, which, it would seem from the map of the preceding day (18th), should not have been; for on the 18th of October it was, and had been, very warm for the season. At 7:35 a. m. the thermometer at Washington stood at 69°, and through the day the heat greatly increased, and it seemed like summer. The center of low barometer as to longitude was about on the line of 82° east from Greenwich—north of Ohio, in Canada—while its center as to latitude was about 47.30° north, making it generally warm over the greater portion of the United States east of the Mississippi River. This being the condition of things on the 18th of October, we in the vicinity of Washington expected that it would be hotter, if any change, on the 19th, and perhaps we might have some light rain. It was quite cloudy, it "felt like rain," and the weather map for this day if anything bid us expect a light rain. But on the 19th, instead of being warmer with a light rain, it became quite cold. A northwest wind carried all the clouds away and left the sky so clear that night that stars of the third and fourth magnitude were as plainly visible as on a clear, cold night in winter, and such small constellations as the "Dolphin" stood out in bold relief, it being a most beautiful night for "star gazing." Monday, the 20th, it was still cool and pleasant, though as the day advanced it began to get cloudy. The 21st it was much warmer, and we had a fine and gentle rain—the rain, it would seem, we should have had on the 18th.

All this time the LOW that was to the north of Ohio on the 18th had been traveling eastward, and the maps of the 19th and 20th showed LOW where it ought to have been, viz: in the northeast. On the 21st, in Washington and vicinity, we again felt the effects of a northern LOW, with mild weather and rain.

Why did we not have this rain before, and why have it now? Why a clear sky and cold, when it would have seemed that we should have had it warm with light rain? Why this double sudden change—first from rain to cold and moisture to dryness; then from cold to warm with rain?

There is one feature in this area of low barometer that is peculiar (yet it was referred to in the "New View of the Weather Question," published in the REVIEW, July and August, 1878); that is, a large area of low barometer will occa-

sionally divide up, and, in place of one large area of LOW, we have two or even more smaller and more concentrated ones. On the present occasion this was evidently the case, though it can only be proved under such circumstances as this happened to be, *a posteriori*, as the lower portion of the area of low barometer had passed off the coast. When this effect takes place on land, which it occasionally does, there is no trouble to prove it beyond all doubt. So there is no doubt but that it does take place, and when it takes place certain conditions of change are sure to follow. Now, when these changes are similar, even though this point has passed off on the ocean beyond our reach, we have conclusive evidence, particularly from the direction of the wind, as to where this area of low barometer must be, for, though the "wind bloweth were it listeth," it *always* "listeth" to blow toward LOW. From this fact we may, relatively to us, locate the direction in which lies the area of low barometer. On this occasion (October 19 and 20, 1879) it was as cold in Washington as in the northern part of New England, for the reason that we here had a northwest wind, while they had a southerly wind. Seven degrees of latitude would at this season of the year, under ordinary conditions, make a great difference in temperature; but on this occasion the wind that made it cold here came from further north than New England, while in the higher latitude of New England the cold was counterbalanced by winds from the south toward the northern area of low barometer on this occasion. This lower portion of the area of low barometer, which here caused a northwest wind, passed beyond our limits; so on the 21st we ceased to be affected by it, but were affected, or re-affected, by the area of low barometer that lay to the north of us, it being a continuous part of that which had passed off the coast on the 19th and 20th. Then followed a sudden change to warmer weather with rain, or taking up of the weather of the 18th—going back to it, as it were.

It is useless to refer to a multiplicity of these cases, unless their condition and change are uncommon. I will, however, mention one more case—one not so uncommon as these other two, but to show what effect the area of low barometer has upon the weather, making it relatively warm or cold without much regard to the season, be it winter or summer; that is, making it very warm for winter or very cold for summer.

December 3, 1879, an area of low barometer started in the West about on the latitude of Washington. On the 4th it was very well developed west of the Mississippi. The indications were that it would reach Washington about the 6th (Saturday), and, if it kept on a low line, make a cold north wind here that would result in a snow storm. But, as the area of low barometer almost invariably trends as it advances toward the east more or less to the north, the chances were more in favor of rain than snow. If LOW followed its usual course, it would rain, and be a warm rain at that. On the 4th it began to be cloudy here. On the 5th the cloudiness increased. On the afternoon of the 6th the advance of the storm proper, or rain area, reached Washington, and increased as it advanced. Toward evening the rain came in abundance, and the temperature continued very mild.

This mildness of the weather here proved that the center of the storm was to the north of this locality. From the effects of this LOW the weather was very mild for a number of days, proving that, though a winter month and the sun in the southern solstice, it will not be very cold so long as the area of low barometer is on a high latitude.

The area of low barometer immediately following this (of the 4th of December to the 8th), from the 8th to the 12th of December, went over almost the same ground and produced the same effect. It continued warm and commenced to rain, and cleared off in the same manner and in almost the same time to an hour. And thus it will do every time—like effects in this, as in other branches of science, will produce like effects.

In the storm of the 15th of August, as to temperature, we had an illustration of the effect of a low barometer in a low latitude in summer. On the 6th and 11th of December, in the same place, we had an illustration of a low barometer in a high line of latitude in winter. The effect of the former was to make it unseasonably cold in summer; the effect of the other was to make it unseasonably warm in winter. Whenever these conditions occur like effects will follow.

[Seeing that there was a little delay in the publicatlon of this article, the writer concluded to insert a few additional comments on the warm weather that we have had thus far this winter—January 10, 1880.]

Additional proof of the fact that Low, traveling on a high line of latitude causes it to be warm, is seen in the warm open winter which we have had thus far. Such weather—weather out of season—cannot be explained in any other manner; and this explanation is not only positive fact but as satisfactory as that heat will create warmth or that the magnet will attract iron. So long as Low continues to travel on this high line, so long will we have such results, and the higher the line on which it travels the warmer will it be. Not until Low travels on a lower line of latitude will we have cooler weather, and the lower the line on which it travels the colder will it be. On the latitude of Low depends the temperature of our planet—at least away from the immediate vicinity of the equator. Cold summers are caused by Low traveling on a low line—warm winters by it traveling on a high line. The fluctuation of Low is the great cause of the changeableness of our climate from season to season.

The location of the area of low barometer, as it were, defies the seasons. It is the great leveler and intensifier of heat and cold, dispensing its gifts without regard to seasons, bringing heat here and cold there at will, defying the apparent natural condition of summer and winter, tempering the heat of one and neutralizing the cold of the other. A sort of uncertain, capricious power that develops weather out of season, introducing sudden changes, transporting the sun's heat hither and thither quite in opposition to the location of the sun's position in the ecliptic, probably the most capricious, uncertain and mysterious power in all nature, the re-adjuster of temperatures—such is Low.

We know that Nature is abundant in her changes; yet the laws that gov-

ern the weather are not unlike any other laws of nature. The whole is after one grand general plan with infinite varieties in detail.

Perhaps some persons may think these comments and explanations ingenious rather than true. Let any one who may think so examine the weather maps for the days herein mentioned. These maps are not made to order to fit the storm, but are made prior to the storm—in advance of it. In other words, the conditions that will cause the effect are put into a stereotyped form and thus proclaimed and advertised to the world long before the storm reveals itself to the senses of man. A person who can doubt such evidence as this can have no faith in anything. Then, as a writer on this subject, I have no desire nor aim in making any other statement than the records of the daily weather maps will warrant. It would be foolishness in me to make any statements that are not positive facts for the mere purpose of sustaining any pet theory. Whether the facts will warrant the comments, that is another matter. They are here made with the utmost personal confidence in them, and they are intrusted to the future. Let the future disprove them if it can; so long as the interest of this department is advanced, it matters little. In this connection, let it be borne in mind that this science is yet in its infancy, and in this state it may not be unnatural to make some false steps, though the direction, as a whole, may be in the direct line of truth.

The more one studies this subject the more beautiful are its revelations and the more forcibly does it present itself that there should be more stations, especially in the Southwest—in Mexico—and that steps should be taken either to induce Mexico to establish a number of stations—say one on a square of every hundred miles—or else give the United States the privilege to do so, and in either case to have the daily reports transmitted to Washington, as are all the other reports. The Government should also exert itself to establish a station in the center of the Gulf of Mexico. This, with a few more stations in the extreme West, would give the United States a far more perfect and a most complete weather system.

Within ten years we have accomplished wonders in this line. The publication of the daily weather maps has proved to be one of the grandest inventions, acquisitions and incentives to science that the world ever had. Facts have been obtained and utilized that, but for this system, must have lain concealed with no hope of a resurrection or bringing to light.

It would seem to be wise in us not only to continue the present work, but to extend its borders, for thereby we extend its usefulness and add wonderfully to our storehouse of knowledge of the works of the Great Jehovah—the Great Architect of the Universe.

WASHINGTON, D. C. December, 1879.

METEOROLOGY OF KANSAS CITY FOR 1879.

BY H. P. CHILD.

I have noticed in the REVIEW and our daily papers, Meteorological reports from St. Louls, Leavenworth and Lawrence, but none from Kansas City. Permit me to supply the omission with the following brief summary of the temperature and fall of rain and snow at this point during the year of 1879.

TEMPERATURE.

MONTH.	7 A. M.	2 P. M.	9 P. M.	MEAN.	Maximum Temperat're	Minimum Temperat're	Mean of Wrm'st Day	Mean of Coldest Day
January	16.22°	29.97°	21.16°	22.12°	52°	—22°	49.00°	−1.00°
February	24.82	41.53	31.75	32.46	72	2	53.00	10.00
March	39.10	56.61	45.94	46.89	89	12	72.25	24.00
April	48.63	65.33	54.66	55.82	89	14	74.50	32.50
May	62.48	79.42	64.96	67.95	93	40	81.00	54.75
June	69.13	83.36	70.73	73.48	96	44	85.50	56.50
July	72.84	85.29	76.87	77.97	96	55	85.00	70.00
August	69.26	84.94	73.19	75.14	100	47	85.25	63.75
September	57.23	75.86	61.93	64.23	92	39	79.75	51.25
October	53.06	68.93	58.77	59.88	87	24	79.00	32.50
November	38.53	50.00	42.73	43.50	75	15	64.50	24.25
December	20.58	31.22	25.19	25.54	65	—11	50.25	−2.50
Year	47.65	62.70	52.33	53.75	100	—22	85.50	−2.50

PRECIPITATION.

MONTH.	RAINFALL, in inches.	SNOW, in inches.
January	.84	1.70
February	0	4.85
March	1.05	0
April	3.56	0
May	1.99	0
June	9.02	0
July	6.35	0
August	.65	0
September	3.55	0
October	4.74	0
November	5.57	1.50
December	3.05	2.00
Total for the year	40.37	10.05

Rain fell on 112 days.

Snow fell on 20 days.

Hail fell on 5 days.

First frost of the present winter, October 18th.

First ice of the present winter, October 23rd.

First snow of the present winter, November 28th.

PHILOSOPHY.

EVOLUTION AND CREATION.

BY GEORGE C. SWALLOW, M. D., LL. D., PROFESSOR OF AGRICULTURE AND OF NATURAL HISTORY, UNIVERSITY OF MISSOURI.

(*Concluded.*)

II. BY NATURAL SELECTION.

But the most important modification of the theory of evolution, is that of Natural Selection, or the survival of the fittest.

By this theory Mr. Darwin and many others claim that the changes produced in animals and plants by food, climate and other causes, are preserved and transmitted when those changes improve the animal, and give him greater fitness for the conditions of life in which he has been placed; and that those not thus improved will be less able to sustain themselves and will perish in the struggle for life; and thus by the survival of the fittest, animals will be gradually improved until new species are formed.

It is claimed by this hypothesis that the progress of the species will be constantly upward, so that by this development, continued through the ages of the past, the low primeval species have been changed into the higher orders until the jelly speck has become the man.

It will be seen that the grandest results are claimed for this species of evolution. From it we have all the 500,000 varied forms, shapes and sizes which swim in the water, fly in the air and live upon the land.

Any system or theory which thus comes in to change the whole current of thought in our race, should come with good credentials and prove itself in perfect accord with the laws of nature, before it can be admitted as a principle of science.

True science is cautious and conservative; no defect can long escape its probe and scalpel. Very many important conditions must be fulfilled before this theory can be accepted as the origin of all the higher organic beings.

Among others it must be clearly shown that the first animals were of the lowest orders; that these were followed by those a little higher, and these again by others still higher—up and up by minute gradations, through all the thousands and thousands of stages to man, the highest in the scale.

But the facts show no such succession. There is, however, such an approximation to it, as could give the casual observer a plausible basis for the theory of Development. Some of the lowest animals did appear among the earliest forms of life; and there was a continual introduction of higher types until man comple-

ted the series. But when we examine this succession in its details as developed in the rock record of all the vast geological cycles, we find thousands of stubborn facts, which utterly preclude the idea of such a continuous and regular succession from the lower to the higher as the theory demands. A few only of these facts can be examined at this time.

1. In this rising development of the animal kingdom, we have five very marked stages of progress, each represented by a sub-kingdom in the classification. In the Primordial strata, the very oldest rocks known to contain animal remains, we find *Protozoans*, *Radiates*, *Mollusks* and *Articulates*, representing four of the five sub-kingdoms; and these four contain more than nine-tenths of all the animals that have ever lived. If, therefore, development be true, it made a thousand fold more progress at the very outset, when it was working upon microscopic mites, than it has since through all the vast cycles of the Silurian, Devonian, Carboniferous, Reptilian, Mammalian and Human ages. This is scarcely credible.

2. The theory demands a regular succession from the lower to the higher in a continuous series both in time and grade. But the facts show this is not so in a vast number of cases scattered through the whole series from the lowest to the highest. As an illustration, Cephalopods, the very highest order of *Mollusks*, and *Trilobites* high among the *Articulates*, appeared among the first animals, and the first fishes were much more perfect than their immediate successors, and even than many now living.

If the Armor-bearing fishes were developed into the Salachians which succeeded them, the progress must have been like Virgil's *descensus in averno*, easy and downward.

3. Since this theory depends upon the survival of the fittest in the struggle for life, it made a grand mistake when it filled the early seas with a huge race of mailed sharks and ganoids, to be the progenitors of the more perfect and wholly defenseless *Teliosts*.

Science has failed to show how the Cod and Turbot could be the fittest to survive in the struggle for life with their progenitors, the Sharks. There are hundreds of similar impossible successors.

4. Many animals and plants have had no ancestors and no progeny. Trilobites had neither ancestors nor posterity. There was no animal for them to be developed from, and they left none to be developed into. It would take a strong power to develop the Elephant out of any animal that lived before him. The same is true of whole races of plants; as our deciduous trees.

5. The theory demands not only that the lowest of any given order should appear first, but that the highest of the lower order should be followed by the lowest of the succeeding higher order, family or genus. Thus: if A, B, C and D represent successive classes, and the numbers 1 and 5 represent the different orders in these classes, the theory would demand a regular succession from 1A to 5D. Thus—1A, 2A, 3A, 4A, 5A, 1B, 2B, and so on to 5D. But in fac

we usually find the lowest order of any class preceding the highest order of the lower class, thus:

1A, 2A, 3A, 4A, 5A,
1B, 2B, 3B, 4B, 5B,
1C, 2C, 3C, 4C, 5C,
1D, 2D, 3D, 4D, 5D.

The last arrangement represents the actual order of progression from class to class in a vast number of cases; as the transition from the Mollusks to the Articulates.

The Devil fish is the highest of the Mollusks, and the Worms the lowest of the Articulates. But according to the Theory, the Devil fish should be both lower than the Worm in the scale of being, and prior to it in point of time; whereas he is just the contrary in both respects. The Worms were among the earliest animals, and the Devil fish, among the latest. And yet the Devil fish must violate all sense of propriety and all order of time to make the theory good. He must perform the double miracle of transforming his magnificent proportions —a body as large as a steamer's boiler, and arms as long as the jack-staff, into a puny mud-worm, which lived millions of years before his ancestors, the Devil-fishes, were born.

So often is this arrangement true, that it becomes the rule rather than the exception, and appears to be an insuperable objection to the theory.

Many of the changes demanded by Evolution are so supremely preposterous as to provoke a smile and leave the conviction of utter impossibility. The highest Articulate is a tiny insect, and the first Vertebrate, the next in order of the grade, was a huge fish covered with a thick coat of mail. Could you see the earliest fish ever found on this continent as nature embalmed him in the rocks of Indiana, side by side with his insect ancestor, you would think it would require about as much of a miracle to develop the fish from such an ancestor as it would to make him from the dust.

6. If all plants and animals have been born of development, there ought to be some proof of such changes within the 5,000 or 6,000 years of the Historical Period. But there is no record, no proof, no claim that a single species has been produced in these long ages. Some have become extinct; but none have been added even by man's aid. We are reminded of many changes producing varieties; but of none that claim the distinction and permanence of species. And besides, nearly all the important variations have been produced by man in the domestic state.

The variations of the domestic pigeons are perhaps the most marked, and Mr. Darwin has made them most prominent. Still the extreme varieties are fertile among themselves, and their progeny show marks of the original stock and a disposition to return to the Rock-Dove.

We are also referred to the Berkshire as a great improvement on the wild boar, and the Spanish Merino on the wild sheep. But there is about as much

proof that the Hydraulic Ram is the result of development as there is that the Spanish Merino comes from a survival of the fittest in a region populated with bears and wolves and hyenas and lions.

But what claim has the Berkshire to superiority as the fittest to survive? Fat? Yes, fat brings more dollars and cents! but dollars and cents do not mark the scale of superiority among animals. If fat makes perfect, then the opossum is superior to the squirrel, the hog to the horse, and the African to the Caucassian.

If, however, the Berkshire is a fair sample of development, he should be able to survive in an open struggle for life with his undeveloped ancestor. The test is easily made. Turn your Berkshires into the forest with the wild hogs; place them together for the struggle in the same arena where the survival of the fittest, according to the Theory, has won so many victories in producing so many thousand new animals. No one can doubt the result. If the Berkshire survives at all, it is because he will lose what makes him a Berkshire, because he becomes a wild hog, as many a fat pig has done before.

This trial was made under the most favorable circumstances during the late war. By Order Number 11, Berkshires, Chester Whites, Poland Chinas, and Racers were turned out to struggle for life in our western counties. A few years after I was surveying that country and saw many of these hogs and their descendants. But few indications of the improved breeds remained, and the younger specimens bore decided marks of lapsing to the original type. And this is what we should expect from the very laws of life.

There are volumes of facts to show that horses, oxen, dogs and hogs, running wild, gradually lose all domestic variation and assume a uniformity of color, size, and structure supposed to be, and in some cases known to be, like the primitive wild stocks.

This is clearly shown by the wild horses of Tartary, and in a less degree by the wild horses of the Falkland Islands and South America, and the semi-wild herds of the North American Indians. The wild horses of America have changed less as they have been in a wild state a much shorter time.

But the variations in domestic animals are much less than would be, at first thought, supposed. Those which are at all marked, are confined to a few species; while the others have scarcely changed at all for many thousand years. Many figures and embalmed specimens of our domestic animals and plants, have come down to us from the ancient nations of Mesopotamia and Egypt, which shows that their living descendants have made no material progress for the last forty or fifty centuries. We also have still more ancient proofs of this permanence of type in the domestic animals and plants from the ruins of the Swiss Lake dwellings, and the Danish Shell-heaps, and the Cave-dwellers of Central Europe.

Should it be even admitted that domestication has produced new species, the fact would scarcely make the evolution by natural selection possible; since there is so little analogy between the possibilities of the domestic and wild states.

You might as well attempt to prove that our native Crab-apple was developed from the Haw, because man can grow Bellflowers on the domesticated Siberian Crab, as to prove the horse was developed from the ass, because the carrier pigeon is the progeny of the wild Rock-dove.

This difference of possibilities between the wild and domestic state, is well shown in the hog and pigeon. Great as are the changes produced in the domestic hog and pigeon, it is known that their wild representatives have made no perceptible changes since the flood, either by natural selection or by the survival of the fittest.

If then we would measure the probabilities of forming new species by natural selection, our illustrations must come from the natural or wild state ; since that is the only state where natural selection can act, and the only place where species have been formed, if formed at all, by natural powers.

We must, therefore, hold the changes produced by man in domestication, of little value in this discussion.

7. But every one of the numerous breaks in the series of animals, has a significance of the highest value in this relation, since each and every one of them must prove fatal to evolution. For Pope's couplet is emphatically and literally true here :

> "From nature's chain whatever link you strike,
> Tenth or ten thousandth, breaks the chain alike."

And yet there are hundreds of thousands of these breaks, missing links, impassable gulfs, over which science has found no bridge.

But it is said the missing links are buried in the Geological Records. This is a delusion ; for Geology is the most unhealthy place for Darwinism imaginable.

To illustrate : let us examine one only of these many thousand breaks in the succession ; and let us take one with which all are familiar, and one that presents the fewest difficulties to the progress of evolution—the link between the monkey and man in its physical aspects.

All admit there is a break between the man and the monkey, as they now exist, which must be filled by a series of beings gradient by small steps of progress from the monkey to the man. These gradient beings must have been very numerous and of too remarkable a character to be overlooked if now living, or for their remains to be lost, if they ever did live.

(a.) It is very remarkable that all these gradient animals, which connected these two living races, and by which the monkey was developed into man, should have utterly perished. All the gradients, all the links between the Carrier Pigeon and the Tumbler, and those between the Bull-dog and the Grey-hound, are still living and more numerous than ever before. Will some Darwinian tell us why all of man's nearest and best ancestors have become extinct, while the hundreds of thousands more remote and less desirable, still live like poor relations to remind us that we are something worse than mortal?

If these gradient animals between the man and the monkey were fitter to

live than the monkey, as the theory of Evolution implies, why have they all perished while so many monkeys live?

(b.) Men and monkeys have lived together upon the earth ever since the origin of man, some time in the Drift Period, which evolutionists say was 300,000 years ago; and the monkey came into being in the Eocene, the dawn of the vast cycles of the Tertiary. This surely gives us time enough to test the theory.

The monkeys have left their remains, recording their history in all the rocks of these vast cycles and in all the continents, in Asia, Africa, North and South America and in Europe. Their history has been tolerably well written up.

Man has lived in Europe since the Drift Period, in Asia and Africa probably as long, and in America nearly as long. He has buried his bones and scattered with free hand his implements, his carvings, his monuments, his temples, his dwellings, his traditions, and his books all along the ages and all over the world. From these abundant materials, man's history, too, is pretty well made up.

Man has searched with untiring zeal for all that is new and old; he has desecrated tombs and temples to lay open their mysteries; he has exhumed ancient cities—Herculaneum, Troy and Nineveh give up their hoary records—he has, also, fished up from the depths of Swiss lakes the remains of their ancient Lake Dwellers; unearthed the Mound-builders and Aztecs of America; dug up the Cave-dwellers of Europe; and searched all the rocks these hundred years; and yet he has not found a mark nor a fragment to show there ever were any beings between the man and the monkey, that man was ever any more like a monkey than he now is, or that the monkey was ever more of a man than now.

The embalmed men and monkeys of the Egyptian tombs, are the same as the living men and monkeys; no nearer together, no farther apart.

The still more ancient traditions and mythologies make the most ancient men heroes and demi-gods, quite as perfect as we are.

Of the pre-historic man, the most ancient relic found in Europe about which there can be no doubt or dispute, is the Engis skull. Of this skull, Prof. Huxley says: "It is a fair human skull."

The oldest skull found in America about which there can be no question of origin, is the New Madrid skull, which is a fair Caucasian skull, It might have been that of a Hebe or of an Eve.

We also have ancient skulls of a lower type; but none lower than the skulls of some living men.

The history of the monkey shows that he is no nearer a man now than he was at the beginning. The rocks show no intervening varieties.

We must conclude, therefore, that the wide chasm between the physical structure of the man and the monkey is not and never has been filled; and that there is no evidence whatever making it physically possible to derive man from the monkey.

III. EMBRYOLOGY

But one of the most plausible arguments of the Evolutionists is drawn from Embryology. The embryos of the higher animals resemble the embryos of the lower ones in the early stages of development; therefore, the higher animals are developed from the lower. As the embryo of a man is like a fish at one stage of its development, so man was developed from a fish.

But Agassiz, who had studied Embryology more thoroughly than any other man living or dead, said this argument had no valid foundation. No embryo has produced a being either above or below the parental species. Prof. Virchow, the best living authority, bears the same testimony as Agassiz.

IV. THE ORIGIN OF THINGS.

But if all other difficulties were removed, if there were a complete series of animals from the lowest to the highest—all having such close affinities that each could be traced to its ancestral species, there would still remain three insuperable objections to Evolution as a system of nature.

1. It does not account for the Star-dust, the original matter from which the worlds were evolved.

Development is the evolving of something out of something else, or some other thing. Hence Development cannot evolve something out of nothing, or the original matter of the worlds out of nothing.

And, besides, Development acts by the laws of nature and by these laws only. But these laws are mere properties of matter, inherent in and dependent upon matter for their powers of action and for their very existence. These laws, therefore, or Development acting by them, cannot originate the matter of which they are the mere properties.

Science clearly indicates a first cause, which must be without and superior to nature. Science too, as such, must accept whatever first cause best meets and explains all facts and conditions of the natural world, whatever first cause is in best accord with science itself, or the laws of nature.

Several theories of the origin of the material world have been proposed. But that promulgated more than 3,500 years ago by one Moses, a learned Egyptian, declares the first cause to be a supreme being, immortal, invisible, all-wise, benevolent, and the Creator of all things.

Scientists have generally accepted the *Mosaic Theory*, as in best accord with the teachings of science itself. It is true that men love to hear and believe something new and strange; but neither common sense nor science will give up this theory of a Creator until something better is proposed. You might as well expect the passengers of an ocean steamer to give up their good ship in mid ocean and take passage in a leaky skiff, as to give up the Mosaic Creator for Evolution

2. Evolution gives no solution of the origin of life and the peculiar structure of Organic Beings.

Science has clearly shown there was a time when neither plant nor animal

existed on the earth; when there was nothing but inorganic matter, dust and rocks.

There were no laws governing life and living beings; for there were no life and living beings to be governed.

But in the progess of events, plants and animals appeared upon the earth, and with them the laws, such as digestion and assimilation, which control organic beings.

Several theories have been proposed to account for the origin of living things. Among others we have had Spontaneous Generation, the Fortuitous Concourse of Atoms, and Evolution. Which of these is most plausible, I am unable to tell. And it would be difficult to say in what they differ.

But none of them are known in nature; science has as clearly proved them impossible as it is possible to prove a negative, by showing that all living things come from eggs and that all eggs are produced by living beings. So certain are we of this that our laws and jurisprudence are based upon it. Upon its certainty we imprison and hang men and women. In short we hold this scientific principle more sacred than we do property, character and life itself.

How then can we believe in spontaneous generation? in the evolution of animals?

It is quite certain that Evolution cannot produce living things; for in them we find life, and new laws so strong as to overcome the pre-existing laws. The laws which raise up the oak and the elephant, overcome gravity and inertia; and those which form sugar, starch, blood and muscle, overcome the pre-existing affinities.

Evolution can only transform, and there was nothing in nature to be transformed into life.

But it is said that Evolution works through the laws of nature. But no facts, no science, has shown that one law can produce another law superior to itself.

It is therefore utterly impossible for the Evolution Theory to account for the origin of organic beings, and the laws of life.

Here again, the Mosaic Theory is the only one, yet proposed, able to solve this problem of the origin of living beings. The Supreme Being of this theory, has the power, the wisdom and benevolence to give the life and the superior laws of organic beings. And there are no facts, no science, which militate against this Theory of Creation, though promulgated 3000 years before the rise of modern science.

If on the morrow, we should find new houses and cities springing up all over our prairies, houses not made with hands or any other known power; if we should see the soil rise up into the houses and form itself into foundation ashlars harder than adamant and more beautiful than rubies; the clay rise and form itself into bricks in the wall, more delicate than opal, and the sand into windows as clear and sparkling as diamonds—all forming houses more gorgeous and brilliant than the palaces of the Arabian Nights; if we could see cars rolling through

the mid heavens without track or engine, but self-poised and self-impelled, and leaving trails as bright as rainbows; if on the morrow we should see for the first time such wonderful beings with power to multiply themselves indefinitely, would we say they had sprung spontaneously from the earth? that they had been produced by development? or rather, would we not say they are the work of some supernatural power? that they are the creatures of the Supreme Being of the Mosaic Theory.

Should such new and wonderful beings appear, it would not be so strange as the first animals and plants were. Man might think he could build a house; but none save Drs. Crosse and Bastian, would undertake to make the oak or the elephant.

3. We find in man, in all men everywhere, a strong innate apprehension of some external invisible power, which, in greater or less degree, molds our destinies and metes out to us the good and evil of life; whose anger, therefore, all deprecate with sacrifices, and whose favor all propitiate with prayers and vows. Some call this universal element of man's nature by one name, some by another. Comte calls it superstition, Virgil, piety, Sir Humphrey Davy and Dr. Carpenter call it religion.

Call it what you will, no animal but man has it. No animal but man has a moral nature, knows right from wrong, repents, prays, sacrifices. No monkey has superstition or religion; no brute fears or loves the unknown powers, whether they be gods or demons.

Hence there is nothing in the brute that can be developed into man's religious nature. You might perhaps develop a monkey out of his tail, and make him stand erect; his posterior hands may be transformed into those beautiful things concealed in No. 2 gaiters; the teeth and facial angle changed; the diabolical grin transformed into the ineffable smile of a mother's love; yea, and that tongue taught to utter the words of affection, fidelity and truth. While we admit the possibility, but not the probability of these wonderful changes, we most positively declare that science has shown no fact, developed no principles, indicating the possibility of deriving man's moral and religious natures from any intellectual power of any brute.

But the Theory of Moses recognizes and provides for this higher nature of man. "God breathed into his nostrils the breath of life, and man became a living soul," an "Image of God."

Thus Moses places man infinitely above all other animals, gives him a brotherhood with angels, and a sonship in Deity.

Shall we then give up this Creation of Moses, which thus elevates us and unites our destinies with the infinite, for this Evolution of Darwin, that links us to the worm, gives us a sonship in the monkey and binds us to the beasts that perish?

As a Christian student of science, I protest. In the name of all the splendid achievements and utilities of science, in the name of all the grandeur of moral truth, and all the sublime hopes of immortality, I am compelled to protest against such a sale of man's birth-right.

BOTANY.

GEOGRAPHICAL DISTRIBUTION OF CERTAIN TREES AND PLANTS IN MISSOURI AND KANSAS.

BY PROF. G. C. BROADHEAD, PLEASANT HILL, MISSOURI.

A thorough study of the passage of the flora of the woodland regions of the Mississippi valley to that of the prairie regions lying west, involves much labor, with instructive results.

Starting from the warmer temperate zone near the mouth of the Ohio river, passing a little north and then westwardly as far as central Kansas, we cross about five irregular and obscurely defined timber lines.

I. The first may include the swamp region of southeastern Missouri, extending into Arkansas on the south and into Kentucky and Tennessee on the southeast. Trees peculiar to this district and not found northwardly, except where transplanted, are: *Taxodium distichum*, or bald cypress, *Catalpa bignonioides*, *Nyssa aquatica* and *N. uniflora* (tupelo), and *Gleditschia monosperma*, or water locust. Occasionally, growing upon these trees, may also be found the *Phoradendron flavescens*, or mistletoe. The elevation of this, generally swampy, region is not much over 300 feet above the sea, and is very heavily timbered.

II. The second zone may be called the pine belt. Its northern line passes westwardly through St. Francois, Washington and Pulaski counties, and southwestwardly through McDonald county, Missouri. Its elevation reaches from 400 to 1,400 feet above the sea, and it is generally heavily timbered. The underlying geological formations are chiefly of the older Palæozoic—lower magnesian limestone and sandstone of the Calciferous and Potsdam, resting in the Iron Mountain region on Huronian porphyries. On the higher flinty and sandstone ridges the yellow pine (*Pinus mitis*) is often found, forming extensive forests of excellent timber. The black gum (*Nyssa multiflora*) grows throughout, but is found no farther north. The yellow poplar (*Liriodendron tulipifera*) is found only in southeastern Missouri, extending from Madison county southwardly and eastwardly. The sweet gum (*Liquidamber styraciflua*) and witch hazel (*Hammelis Virginiana*) are also only found in southeastern Missouri and southwardly. The Wahoo elm (*Ulmus alata*) is quite abundant near the Iron Mountain, where it attains a diameter of one foot and a height of forty feet. It disappears at the Missouri bluffs, where it is found only as a small bush a few feet high. The *Bumelia lanuginosa* is also found as far north as the Missouri river and as far west as Jefferson City. Thence its northern limit passes southwestwardly through Cedar and Jasper counties. It very much resembles the Osage orange bush.

In northern Arkansas the chincapin (*Castanea pumila*) is often found,

and attains the size of a small tree. It may rarely be found on the south line of Missouri. In southeastern Missouri, southern Illinois, and eastwardly, the beech (*Fagus ferruginea*) is found.

Nearly the whole of this district is well timbered, for, besides its extensive pine forests, the white oak, burr oak and post oak are common everywhere, and we occasionally find dense cedar groves.

III. This zone lies north of the last, its northern boundary extending from northeastern Missouri southwestwardly via Boonville, through Henry, Cedar and Jasper counties, Missouri, and Cherokee county, Kansas. It lies from 500 to 1,500 feet above the sea. It includes the oaks above named, and is the extreme western limit of the blue ash (*Fraxinus quadrangulata*), the hornbeam (*Carpinus Americana*), the alder (*Alnus serrulata*), the flowering dogwood (*Cornus florida*), and the huckleberry. Valuable timber is abundant, consisting of oak, walnut, hickory, ash, sycamore, cottonwood and maple. This portion of country is chiefly underlaid by Silurian, Devonian and Carboniferous rocks, mostly limestones.

Passing from the woodlands of Missouri, we notice a gradual disappearance of large bodies of timber, with the loss of some well known trees and much of the characteristic undergrowth. The prairies are large, and a western flora appears. The sassafras and white walnut (*Juglans cinerea*) we find in Saline, Lafayette and Carroll counties, Missouri, but no where else beyond the bounds of our third zone. The red birch (*Betula nigra*) and the trumpet creeper (*Tecoma radicans*) extend as far west as Pettis, Johnson and Bates counties, but no farther west.

IV. Another partially defined boundary may extend southwestwardly from the Nodaway river via Kansas City and along the western boundary of Missouri southwestwardly. West of this we do not find white oak (*Q. alba*) and swamp white oak (*Q. bicolor*), and the laurel oak (*Q. imbricaria*), in a few instances, is found west. Certain smaller plants extend westwardly and southwardly, but are not found east, viz: *Oenothera speciosa* and *Salvia azurea*.

V. This extends from the last to what is known in Kansas as the "Flint Ridges." This ridge enters Kansas on the line of Chautauqua and Cowley counties, and trends northwardly. Its elevation here is from 1,600 to 1,700 feet above the sea, and is a good natural division. The black walnut, red elm, American elm, box elder, sycamore, cottonwood, white maple, hackberry, redbud, red oak, pin oak and burr oak are the principal trees and are also found East. In the eastern part of Kansas, and especially near the larger streams, the Maries des Cygnes, Kansas and Missouri rivers, are some good bodies of timber; but going westward we find the timber restricted to the valleys—the belts becoming narrower as we go west. The hazel is found in Anderson county, but not much farther west. The shellbark hickory stops at Walnut creek in Greenwood county. On some of the larger streams the trees are tall, but westwardly we find them depressed and rough looking. In the western portion only three oaks remain—the burr oak, red oak and pin oak. All the trees have become dwarfish, and the burr oak, black walnut

and elm are short and stout. We find also that the bark of most trees appears more gray in color. The strawberry, *Fragaria Virginiana*, is not found west of the "flint hills."

VI. This zone may almost be called treeless, for only stunted trees are found along the larger streams, and fuel is scarce. Near the Arkansas the "sand plum," a dwarf plum (*Prunus texana*), is abundant. We also find the *Ribes aureum*, or yellow flowering currant, on limestone glades bearing fruit, whereas eastwardly, when put out for ornament, it is said not to fruit.

GENERAL REMARKS.

The American plum, blackberry, raspberry, pawpaw and gooseberry grow throughout the various districts just named. Probably also the *Vitis riparia*, *V. cordifolia*, and *V. aestivalis*, var? *cinerea?* Eng. The *Prunus chicasa* grows in I, II, III and part of IV. The *Ptelia trifoliata* occasionally is quite abundant in II and III, but rarely in IV, while I have found quite a number of bushes of it at Avondale, Franklin county, Kansas. The *Acer saccharinum* or sugar maple is occasionally quite abundant in Eastern Missouri, also on the Missouri river bluffs as far as Platte county and is reported to be found near Fort Scott, but no farther west. The *acer rubrum* or red maple is only found in Southeast and central Missouri. The *Ostrya Virginica*, or iron wood, is found on rocky hillsides as far west as the Verdigris river. The black jack (*Q. nigra*), is generally common wherever sandy soil exists, and is found as far west as Greenwood county, Kansas On limestone bluffs in Western Missouri and Eastern Kansas the *Quercus Muhlenbergii* is generally common, growing to a diameter of two to three feet. Post oak is generally associated with black jack, although it selects a little better soil. The black jack prefers sandy soil, the post oak requires some clay with it The pecan (*Carya Olivæformis*), is found on the Mississippi bottoms above its junction with the Missouri, and along the Missouri as far as the vicinity of Kansas City, on North Grand River to Utica, is abundant on the Maries des Cygnes, in Bates county, Missouri, and is also found near Ottawa, Kansas. It abounds also on the Little Osage, Marmaton and Neosho rivers. Near the Flint Hills, the only hickory observed was the common pignut. The persimmon (*Diospyros Virginiana*) is not found in Northwest Missouri, but is found in Linn and Clay, and thence southwestwardly in Kansas. The cedar (*Juniperus Virginiana*), although common in Central and Southeast Missouri, is elsewhere rare, but may be expected on rocky bluffs. I found it in Cowley county, Kansas. The leatherwood (*Dirca palustris*), is abundant on some bottom lands in Madison county, Missouri, and is also found in Warren and Calloway counties, but no farther north or west. On the prairies in Western Missouri and Kansas wherever limestone approaches the slightly moist surface we are generally sure to find the *Desmanhuts brachylobus*, and where the same soil, overlying limestone, is dry we may find the *Helianthus orgyalis*. The latter plant is generally called "rockweed" near Fort Scott. The large plant *Helianthus lenticularis*, in some parts of Western Missouri and Kansas

abounds on rich black soil. A few years ago the *Solanum rostratum* was restricted farther west. It is now found in Saline county, Missouri. The beautiful *anemone Carolinianum* is found in Western Missouri and westwardly. The handsome *Callirrhoe digitata* I have only seen on limestone and flinty soil in Southwest Missouri. The *Clitoria Mariana* is only found on dry pine ridges of Southeast Missouri. The *Oxytropus Lamberti* I have only seen in extreme Northwest Missouri. The *Œnothera speciosa* abounds in Western Missouri, southwardly and westwardly. The *O. missouriensis* is rare in Southwest Missouri, more common westwardly. The *O. serrulata* abounds in Butler county, Kansas. *Silphium terebinthinaceum* abounds in Southern Illinois, Southeast and Central Missouri. *Conoclinium cœlestinum* is abundant in Southeast Missouri, and is also found in Cole, Bates and southwardly. The *Amphyachyris dracunculoides* is common in Western Missouri, Kansas and southwardly. *Pentstemon grandiflora* is found in Atchison county, Missouri and in Kansas, becoming quite common in Butler county. It is quite handsome. *Salvia azurea* is abundant in Western Missouri and Kansas. *Phlox acuminata*, common in Southeast Missouri, also found in Cole and Vernon counties, but not northwardly or west. *Sabbatia angularis*, found on dry ridges in same districts as the last. *Gentiana quinqueflora* has only been found in cool, shaded places in Adair county, Missouri. *Euphorbia marginata* abounds in Kansas. *Yucca angustifolia* I have found in Atchison county, Missouri and Elk county, Kansas. That handsome cactus the *Mammilaria Missouriensis* is occasionally found where there is but little soil upon the limestones of the Flint Hills in Butler county, Kansas. In Kansas, as far as Butler county and probably farther, the *Psoralea floribunda* is very abundant upon the prairies. In Greenwood and Butler counties the *P. argophyllta* is occasionally found and the *P. esculenta* is found from the western line of Missouri westwardly. In Anderson county, Kansas, the *Callirrhoe involucrata*, *Eryngium Leavenworthii*, *Jussiæa Grandiflora*, *Stenosyphon*, *Virgatus* and *Baptisia Cœmlia* were observed; but we have no information of these plants occurring any farther east. Here was also found the *Nymphæa adorata*, *Brasenia peltata*, which have also been found in Barton county, Missouri. In Woodson and Greenwood counties, Kansas, the *Nemastylis acuta* and a pale blossomed *Callirrhoe* were observed. Four or five ferns have been observed in Kansas growing upon rocks, viz: *Notholena dealbata*, *Woodsia obtusa*, *Pelliea atropurpurea Asplenium ebeneum* and an *Adiantum*.

ADDITIONAL NOTE.—The black oak may be found as far west as the post oak. The service berry being (*Amelanchier Canadensis*) I have found on Marais des Cygnes bluffs, Franklin county, Kansas, also at Kansas City. It is common eastwardly.

DISTRIBUTION OF PLANTS.

BY REV. L. J. TEMPLIN, HUTCHINSON, KANSAS.

The world is full of wonders to every one who has not made up his mind to be astonished at nothing he may see. To the thoughtful mind there is much in nature to inspire wonder and admiration. The wise adaptation of means to ends, and the beautiful harmony that exists throughout all the realm of organic nature lead the mind, free from bias, to the inference that some wise, intelligent power orders and governs all these relations and harmonies. Perhaps nowhere in nature is there a more manifest exhibition of wisdom in the adaptation of means to the accomplishment of a worthy purpose, than is seen in the various methods employėd in nature for the dissemination of plants by the distribution of seeds.

In looking at this subject with an intelligent eye, the mind cannot shut out the conviction that some intelligent designer must have been employed in planning this scheme that has so much of both excellence and variety to recommend it to the judgment To say that all this is to be attributed to chance, is to endow chance with all the attributes of a Deity, which is the very reverse of the idea intended to be conveyed by the term. In the sense intended it is perfectly absurd to attribute this or any other work to chance, for in that sense chance is nothing, and consequently can do nothing. So we regard it as the result of evolution; but I cannot see that this relioves the difficulty, even if the truth of the theory of evolution be admitted. Evolution is simply the working out of certain results under the operation of law. But what is this law? It is not correct to say that it is force, though I think many make this mistake. Law is only the established order or manner in which force operates; so that if we admit the intervention of law and a thousand or ten thousand secondary causes, still this law must have originated with a Law-giver, and behind all these secondary causes the mind must rest at last on the First Cause, the Author of all other causes. But I did not start out to write a moral or philosophical essay, but to call attention to some of nature's methods of distributing the vegetable kingdom over the world. In producing these results we find three classes of agents at work: the waters, the winds, and animals, besides certain arrangements within the plants themselves for the accomplishment of this purpose And we find the seeds themselves adapted to these different means of transportation. The light character of many seeds well adapts them to floating from place to place, while their impervious coverings protect them while being carried long distances by the currents of the ocean or of rivers, and then when they lodge on some island or other shore they readily spring up and grow. What, for instance, can be better adapted to floating from island to island than the tough, corky covering of the cocoanut? The seeds of grasses and other plants are washed down from the higher grounds by streams, and they are thus widely distributed.

The seeds of many plants, as of the dandelion, thistle, and a long list of similar plants, are furnished with a tuft of downy or silky pappus, that will enable

them, when ripe, to float away on the breeze and thus be scattered far and wide. The seeds of some species of poplar, as cottonwood, are attached to a bunch of fine cotton that serves as a buoy to bear them up through the air, by means of which they are frequently carried many miles from the parent tree. Seeds are often disseminated through animal agency. Animals frequently carry seeds and nuts away and bury them for winter food, where they are forgotten and left to grow.

Many seeds of fruits are swallowed by birds and carried to distant places and voided uninjured, and there spring up and grow. Thus the seeds of cherries, grapes, gooseberries, blackberries, and many others of like nature, are sown broadcast over a large extent of country. During an invasion of the Rocky Mountain locusts into Iowa a few years ago, they left the ground where they fed thickly strewn with the seeds of some species of grass, new to that locality, which they had brought from the far Northwest. Many seeds are provided with hooked barbs, by which they cling to clothing and the coats of animals, and are carried about from place to place.

Many people are familiar with the cockle-bur, the Spanish needle, the "beggar lice," and burdock, and how tenaciously they adhere to any surface where they can get a hold. To this we may add the sand-bur (*Cenchrus tribuloides*), with its sharp spines, one of the most execrable weeds I have made the acquaintance of. Some seeds, as of the maple, ash, elm, etc., are furnished with a wing that causes them to sail off some distance in falling. The locust, Judas tree, or redbud, and others, have a light pad that will often sail off to a considerable distance, thus scattering their seeds.

Some kinds of bean have the pod so arranged that when it bursts it suddenly twists into a coil, throwing the seeds a considerable distance. This habit in the *Impatiens*, or touch-me-not, geranium, etc., is well known. The squirting cucumber (*Momordica elaterium*), when ripe, bursts with a considerable report, throwing its seeds many feet.

A few plants, when their seeds are ripe, travel over the country and sow them themselves. A good example of this kind is the "tumble-weed," about the true name of which the doctors disagree. Two species grow here, the larger, which is the tumble-weed here, grows in a thick cluster of very slender branches, and these so numerous that the bunch, which is often as big as a hogshead, can scarcely be seen through. When ripe they are torn from the roots by the wind, and then they roll and tumble, often with the speed of a race horse, till they meet an obstruction that they cannot surmount, and there they rest till the wind changes, and then they start again; and this is kept up till they are worn out and broken to pieces. Their seeds are thus scattered over all the country.

A plant that grows on the deserts of Africa, the Rose of Jericho (*Anastatica heirochuntica*), when ripe, curls into a ball, becomes detached from the soil and rolls about before the wind till a light shower of rain falls, when it opens its seed pods and drops its seeds, which germinate in about eighteen hours. The wisd

of the arrangement here is seen when we remember that if it remained where it grew the whole plant would probably be covered by the drifting sands, and that if its seeds did not germinate quickly, while the transient moisture lasted, they never could grow at all. Thus does nature care for her children.

—*The Gardener's Monthly.*

GEOGRAPHY.

THE BENEFITS OF ARCTIC EXPLORATION.

BY THE REV. J. T. HEADLEY, AUTHOR OF WASHINGTON AND HIS GENERALS; NAPOLEON AND HIS MARSHALS, ETC.

Columbus, in his daring attempt to reach the East Indies by sailing west, struck the American continent, and after feeling his way along the isthmus of Darien, gave it up in despair. But the efforts to reach it in that direction did not cease with other explorers, who finding at last that there was no break in the continent, determined to sail around it. Cape Horn, the southern extremity, presented no advantages over the route by the cape of Good Hope, and hence the attention of the commercial world became concentrated on the northwest passage. From Hudson in 1609, to Franklin in the present century, both of whom left their bones amid the ice fields of the north, all endeavors to find this passage proved fruitless. And when the problem was finally solved by McClune, and it was proved that our continent terminated on the north, just below the eighteenth parallel of latitude, and that the ocean stretched thence unbroken to the pole, it was also determined that for all practical purposes, the discovery was useless.

This being settled, there arose a great desire to reach the pole itself, and see what state of things existed there. The declaration of Capt. Symms that a vast aperture was there, increased the curiosity of navigators, for it surrounded this solitude with still greater mystery, and hence naturally intensified the desire to reach it. Whether it will end, like the search for Eldorado or the fountain of life, in blank disappointment, remains to be seen. The fact that Prof. Maury believes there is an open polar sea, where *the whales have their nursery*, that Agassiz also believes it probable, and says that the discovery of a passage into it would be one of the most important results for the improvement of *whale fishing*, and the declaration of Kane, that one of his crew actually saw it, has deepened the interest in this mysterious part of the globe. The land on our planet seems to hang down like great stalactites from the arctic circle into the southern ocean that is believed to stretch in one vast field of ice from the antarctic to the pole.

No one takes any interest in the southern pole. No conjecture is wasted as to whether an open polar sea exists there, and no attempts are made to reach it. True,

Captain Wilkes was sent to explore it; but how serious and persistent was the effort, may be inferred from the fact that the margin of that frozen ocean which he skirted day after day, only to meet the same solid unbroken line of ice, proved afterward to be no more impenetrable than a bank of fog. Straight over the parallel that he said bounded this unbroken field of ice, ships have since sailed for days directly south, without meeting with any obstruction. No effort is made to reach it, and it is in a double sense "left out in the cold." It is taken for granted that there is neither land nor open polar sea there, nothing of any value to the explorer nor the man of science, and all the interest is gathered around the north pole, and all efforts directed thither. This perhaps is not strange, for the south pole seems outside of human interests, bears no part in human activity, while the north pole is intimately linked with man's destiny. Every time his eye rests on the compass his thoughts travel thither. That compass is man's friend, and to the mariner one without which he would drift hopelessly on the sea. No matter how wild the storm and fierce the waves, its tremulous finger points steadily to the pole. A breath may disturb its delicate vibrations, but it comes faithfully back to its daily and mean trusts, to its faithfulness, as if it were divine. The heavens may be wrapped in darkness, and inpenetrable night surround the mariner, his ship may be whirled about by the hurricane and drift on unknown tides and mysterious currents, yet when his eye rests on the slender, steadfast finger, as the light in the binnacle falls on it, he guides his mighty vessel by its silent index with unfaltering trust. It is voiceless, yet over the roar of the storm and the waves it speaks to man in a language that he understands. Thus the north pole is so completely interwoven with man's interest and destiny, that it is not surprising it should occupy so much of hls thoughts. Great efforts and sacrifices have been made to reach it, man has steadily pushed his adventurous efforts farther and farther north, till he has reached a point only some four hundred miles distant from it. When one plan or road is found to have insurmountable obstacles, another is tried, and both hemispheres are to day making or about to make new efforts to solve the mystery of the north pole. It is not our purpose to speak of the various expeditions that have been set on foot, nor of the last one at this time locked up in those frozen regions. The civilization, enterprise and commerce of the world have been on the Atlantic shores of both continents, hence all exploring expeditions to the north have been started and pushed forward by way of the Atlantic ocean instead of the Pacific. Most have endeavored to pass northward through Davis Straits in which they have been compelled to stem a strong southern current bearing downward immense fields of ice. But San Francisco has furnished a base of operations on the Pacific coast from which the Bennett expedition sailed to attempt a passage through Behring's Straits through which a strong current runs north, and that evidently sweeps around the northern limit of the continent, as branches of trees have passed up these straits from the Pacific and been found afterward coming down Davis Strait. What mysterious law governs this mighty current, and whether it empties into an open sea to pour again south into the At-

lantic, we may never know. The Bennett expedition, entering this great northern current, may burst at length into an open polar sea. If no such sea exists, it may never return to enlighten us respecting this mighty sweep of the ocean around our continent.

The Howgate expedition, as it is called, is based on an entirely new plan, and embraces all the elements of success, if success is possible. Two things have been clearly demonstrated by experience—first, that the arctic winters are as variable as those in warmer latitudes, and hence bays and channels that one year are impenetrably locked in ice, may the next year furnish free passage to ships—second, that in the same season, owing to hidden currents or prevailing winds, channels are opened that admit of a passage to vesesls, which in a short time after, are again closed. Thence, it is plain that a vessel fitted out with every appliance may not reach the arctic regions in a year most unfavorable to any exploration, and the next year may be like it, and so the whole thing prove a failure. Again, a vessel may reach the ice barrier after the only favorable moment for pushing north has passed. Against both these contingencies Captain Howgate's plan provides a remedy. He proposes to establish a colony of hardy men in Discovery bay, provided with everything necessary, so that in any year that the ice opens to them a channel, the expedition may push north, and if there ever does come a time when the polar sea may be reached by a vessel it can be seized. The same may be said of an expedition that should try and reach the same point by sledges. The winter and the times and the opportunity, if they ever do occur, are theirs. Hence we say, whether other expeditions succeed or fail, this plan will succeed, if success is possible. Some nation will have the honor of unveiling the mystery that hangs round it, we have no doubt, and it would be a pity to have American enterprise which has accomplished so much at last outstripped.

It is often asked, why sacrifice so much life and money in these vain attempts to reach the pole? as though curiosity alone or the ambition of the explorer was the ruling motive, and no permanent good was to be accomplished The same question was asked when search was made for Dr. Livingstone in Africa, but behold what future possibilities both to the commercial and Christian world have been opened by it. If there is a polar sea, which sc entific men declare probable, and explorers assert they have seen, what islands may dot its surface, or shores fringe it, teeming with new forms of animal and vegetable life! What new light it may throw on the currents of the ocean! It may prove something more than the nursery for whales: *the great fountain head of the electricity that fills our atmosphere—the grand reservoir of that mysterious magnetic force that pervades earth, air and sea, nay apparently spirit itself.* At the furthest point north man has yet reached, still north of him the nightly heavens are flooded with these strange electric tides that seem but the mere overflowing of a boundless sea in which the very universe seems to float. Who knows but man may yet stand at the pole, and there discuss the laws that govern this invisible, mysterious power that seems to inclose and govern all other physical laws. It is not presumptuous to suppose that, when

instead of gazing from afar on the dazzling corruscations that illuminate half the hemisphere, he shall stand in the very midst of those magnetic splendors, he will be able to tell us more than we now know, not merely of their birth-place, but the secret source of their origin. It is not necessary to speak of the new minerals so invaluable to the industrial arts, found nowhere but in the polar regions, or of the fossils that may throw light on the race that formerly undoubtedly inhabited these now waste frozen spaces, and which according to Esquimau tradition still live far to the north of them. It is useless to mention all the advantages to science that these explorations may secure—one thing is certain, if there is an open polar sea, it is impossible to estimate the value of the results that will follow its discovery.

GEOGRAPHICAL NOTES.

MERIDIAN OF PARIS.

A member of the French Bureau des Longitudes has completed one of the greatest scientific operations of modern times. The meridian of Paris, the imaginary line from which all the French scientific calculations start, passes through the Shetland Islands, Scotland, England, the Channel, and is connected by calculation with trigonometrical points determined in Algeria. The possibility of its extension southward had already been suggested seventy years ago by Arago and Biot, but the difficulties appeared too great to be overcome. A curious circumstance, however, led Commandant Perier to resume the ideas of his illustrious predecessors. In 1868 he was occupied in Algeria in some geodesic operations in the Atlas Mountains, to the south of Nemours, when one day he perceived with the naked eye the profile of the Sierra Nevada, in the province of Granada, Spain, so plainly that he could determine by calculation the position of the two summits Tatica and Mulhocen, about 3,000 meters high. He at once drew up a scheme, which was approved by the Academy of Science in 1872, and the preliminary operations were commenced in 1878. In 1879 the French commission, under the direction of M. Perier, began its work, while a Spanish commission on its side assisted in the Peninsula. The result of these combined labors and calculations is that at present the meridian of Paris is extended across the African continent to the Sahara. The arc thus measured is thirty-two degrees, the largest which has ever been actually measured. The extreme accuracy required in all the data necessitated proofs by every possible means—observations of the visible terrestrial points, the position of the sun, and innumerable observations of the stars, necessitating calculations absolutely bewildering, but which have resulted in fixing beyond doubt the line of the meridian of Paris.

ANOTHER NORTHEAST ARCTIC EXPEDITION.

In a letter to M. Sibiarakoff, Professor Nordenksjöld expresses his intention of undertaking another voyage to the northern coast of Asia as soon as circumstances permit. "After my return," he says, "I think of spending a year in preparing an account of the voyage of the Vega, and it is my desire then to continue the exploration of the icy ocean along the coast of Siberia, making the River Lena the point of departure, and the New Siberian Isles the basis of operations. For the object I have proposed to myself—namely, the rendering of the northern part of Asia completely accessible to commercial shipping—the prosecution of these researches is a paramount importance."

AFRICAN EXPLORATION.

THE ABBÉ DEBAIZE'S FRENCH EXPEDITION.

News has been received from the Abbé Debaize, who started about six months ago from Zanzibar. He stopped some time at Lake Nouami in order to accustom his men to the feverish climate. On October 17 he reached Tabora, whence he struck into central Africa, above the point at which Stanley crossed, his object being to discover something entirely new and to reveal the secret of the blank that exists in the middle of the most modern maps. In his report to the Minister of Public Instruction, the Abbé Debaize states, under the date of October 17, that hitherto his mission had been lucky, and that not one of the hundred men in his caravan had deserted. The Abbé himself had been in good health all along, and had managed to preserve his baggage intact. The Chambers voted 100,000f for this mission.

AN INTERNATIONAL ASSOCIATION.

For many years France, Germany, Austria, Italy, Belgium and Switzerland have had their own geographical societies, and have engaged in the business of African exploration with considerable zeal. But there was no unity, no concert of action, and consequently much money and many valuable services were simply squandered. The French and German travelers sometimes undertook the same problem at the same time; the Austrians and Italians did the same. At last, in 1876, the happy thought of international coöperation and economical division of labor and application of funds occurred to several leading geographers of continental Europe, and this idea was elaborated so far and so successfully that an International Association for the Exploration of Africa was fully and effectively organized, and met at Brussels under the intelligent and distinguished presidency of the King of the Belgians. In this association all the leading nations of Europe were represented except Great Britain, and a branch society was set up in the United States, under Mr. Latrobe's presidency, with Mr. H. S. Sanford (late United States Minister to Belgium) and Mr. Schiffelin, of New York, delegates of

the society in Europe. The organization of the society was very complete and rational. Local geographical societies became branches of the International, which directed movements and disbursed funds. These local societies have two classes of members—those who pay annual dues, ranging from $2 to $5, and those who purchase life memberships at an average of about $100 each. The life membership fund is to be permanently invested. The interest received and the annual dues are applied to the fitting out and support of exploring expeditions. Another part of the society's work, which is most effective and which promises in the end to do a great deal toward opening up Africa to travelers and trade, is the provision agreed upon and put in force for establishing stations or depots at important points on the great routes, where travelers may be received and obtain supplies at their cost. These depots, of which a good number have already been equipped, are to be furnished with goods, provisions, medicines, arms, instruments, etc. They are to be in charge of Europeans, with a native staff, and the person in charge is to increase in every possible way his knowledge of the surrounding and adjacent country and its resources, etc. The Italian government has for years maintained such a station on the frontiers of Abyssinia, and other stations have been founded between Bagamorgo and Ujiji, and at Nyangwe, on the Lualaba. The geographical, ethnological and commercial knowledge to be gathered up in this way will be very extensive and of the utmost importance. Already the reports from the stations embody a vast amount of information.

ELEPHANTS AS AN AID TO EXPLORATION.

The International Association has practically solved the greatest difficulty in the way of the African problem—namely, that of transportation. Hitherto it has taken travelers many months and cost them great sums to get from the coast to the interior. The bite of the tsetze fly, which infests all the tropical regions of Africa, is fatal to the horse, the mule, the donkey and the ox. Consequently, all goods have had to be carried on the heads of porters, who could not carry as a rule more than fifty to seventy-five pounds apiece, who had to be fed and paid, and who were insolent, disorderly, unreliable, and sure to desert just when their services were most needed. As the only currency of central Africa is beads and calico, it took an immense corps of attendants to enable the traveler to get up from the coast, and the more porters the more mouths to feed and the greater the cost of the expedition. The International Society has, however, substituted Indian elephants for porters, and the experiment has succeeded wonderfully. In a letter from Brussels of the date of October 17, 1879, speaking of the progress made by MM. Popelin and Vanden Heuvel, of the Belgian branch, and of the successful passage of the Mahata, we are told that Mr. Carter's elephants joined the explorers in good condition at Mpwapwa. "The elephants, laden with about one thousand pounds apiece, succeeded in crossing the mountains, swimming the rivers and traversing the swamps and ravines. Contrary to the opinion generally received, they were able to dispense with bread, and to subsist on such provender

as the country furnished. They journeyed across the districts infested with the tsetze, the bite of which, as is known, is mortal to horses, cattle and asses. Literally covered with these insects, they did not seem to suffer even annoyance." Another letter of still later date says: "It remains to inform you, sir, that the elephants have so far perfectly sustained all the fatigues and all the privations to which they have been exposed. They braved the Marenga-Ukali; they have remained forty-two hours without water, and thirty-one hours without food, marching twenty-seven hours laden with more than a thousand pounds apiece."

This is conclusive, and it would seem that as soon as the trasportation problem is solved, the complete opening up of Africa to commerce is only a question of time. That continent is very rich in all sorts of vegetable and mineral resources; it has a large population, and all the civilized world is interested not only in finding new markets for their goods, but new fields to which emigrants may go in search of a living.

AUSTRALIAN EXPLORATION.

The Australian government sent out Mr. Forrest in charge of a party, early last year, to explore the Fitzroy River to its source, and afterward the northwest coast to Port Darwin. The expedition consisted of eight men, six Europeans and two natives, with twenty-six horses and provisions sufficient to last six months. The party left Perth on the 18th of January of last year, going by boat to the northern settlement of the colony, from which a start was made, the point of departure being latitude 20° south and longitude 119° east. Mr. Forrest proceeded along the coast, exploring Beagle Bay and King's Sound, and from this traveled through well grassed and well watered but very rough country, to the basin of the Fitzroy River.

This river, at its mouth, is a magnificent body of water, nearly half a mile wide, with numerous lagoons and small lakes along its banks, covered in every direction with water fowl, and the river itself abounding in fish of every description. The explorer could not imagine any better country for settlement, nor one better suited for agricultural and pastoral purposes. It was impossible to cross the river at this point without a raft or boats, and, as the object of the expedition was exploration, the party kept the southern bank of the river without finding a fording place for 250 miles. At this distance a precipitous range of mountains, more than two thousand feet high, abutted upon the river and formed a bar over which they were able to cross.

Up to this point the banks on both sides consisted of plain, open country, covered with luxuriant vegetation, stretching for thirty or forty miles before the usual fringe of blue ranges rose to the view, while lagoons were observed here and there, and tributary streams flowing into the main river at short intervals left nothing to be desired in the way of water. Ships of average tonnage could sail or steam up the river for 100 miles without meeting any interruption.

Above this crossing point the river appeared to flow through high ranges which the horses could not scale, and Mr. Forrest returned thence to the coast, which he reached at Camden Harbor, or the mouth of the Glenelg River. At one time this had been a settlement and a pearl fishery station, but has been abandoned for some years. Finding that the coast was too rough for traveling, he determined to cross the high ranges to the eastward and continue along the table land to the Northern Territory. In this scheme he had more difficulties to encounter than he anticipated.

The ranges were not very high, but very rugged, and for 300 miles they seemed to be without a break, saddle or pass. In every direction they presented a precipitous face. Crag rose above crag, and in the attempt to pass through the rocks the horses were sometimes so closely jammed that it was impossible to extricate them. By this means and by hard journeyings, ten horses out of the twenty-six were killed. The men besides suffered severely from the heat, which was intensified by the reflection from the rocks. One day Mr. M. Forrest, the brother of the leader, had a sudden attack of sunstroke, and as he appeared to be falling, Mr. A. Forrest ran to hold him up, when both rolled together fully thirty feet from rock to rock down to a level spot below, and fortunately escaped with only a few bruises.

After a fortnight spent in a fruitless attempt to cross this range, the project was abandoned and the party returned to the Fitzroy River, keeping about twenty miles south of their former track, and traveling through a level, grassy country.

They found an eastern branch flowing into the main stream in latitude 18° south, and this they followed up to the dividing range in longitude 127° 40′ east. From this point to the boundary of the two colonies, in longitude 129°, Mr. Forrest represents the country as all that the most enthusiastic squatter could desire. Boundless, open, undulating country, covered with tall gaasses, intersected with innumerable rivulets from permanent springs, with here and there large lagoons covered with water fowl, and, at distances of eight or ten miles, large rivers moving slowly toward the ocean. There was no forest observable, except on the immediate banks of the creeks and rivers. For all this, there was one disadvantage —the fever season was now on, and malaria reigned in this district. Several of the men were laid up, provisions were running short, horses had to be killed for food, and, under the circumstances, it was resolved to abandon further exploration and proceed in a direct line to the telegraph wire passing from Port Darwin to Adelaide.

September 19 they arrived at the Katherine station, 240 miles from Port Darwin, alive and well and in excellent spirits, having been exactly nine months in the bush.

Mr. Forrest estimates that he explored upward of 20,000,000 acres of country, well grassed and well watered, and highly adapted for pasturing sheep, horses and cattle, while the plains along the banks of the rivers were suited for the cultivation of sugar cane.

Along the coast hundreds of natives were encountered, armed with spears and other weapons, but they were at all times friendly, and brought the explorers fish and game. In the interior the natives kept at a distance, but the numerous bush fires showed their proximity. They had evidently come previously in contact with the white man, and knew the wisdom of keeping out of rifle range.

ARCTIC LITERATURE.

Two interesting works on past arctic expeditions have recently been published. . One is a record of Prof. Nordenskjöld's Earlier Expedition, compiled by Alexander Leslie, of Aberdeen, Scotland, and published by MacMillan & Co., in one handsome octavo volume of 440 pages, with numerous illustrations and charts. The other is a record of our own Capt. Hall's Second Arctic Expedition, edited by Prof. Nourse, of the Navy Department, and issued from the Government Printing Office, in a large volume uniform with the Report on the Polaris, and, like that work, profusely illustrated. Two of the charts are especially noticeable, showing graphically the amount of arctic work done during the present century, and the route followed by each of the numerous expeditions engaged. Copious extracts will be made from each of these volumes in succeeding issues of the REVIEW.

CORRESPONDENCE.

EGYPTIAN CORRESPONDENCE.

ALEXANDRIA, EGYPT, December 29, 1879.

DEAR SIR:—The winter season is again upon us and we are having our usual quota of invalids and sight-seers, a goodly number of whom come from the land of the dear old stars and stripes. We have Captain Eads, of Mississippi jetties fame, General Noyes, our American Minister at Paris, and many others. About our largest export business this winter promises to be "Cleopatra's Needle." Capt. Gorringe and Mr. Davis and assistants are here to take it away to the New Yorkers, to have them wonder *what it is*. Well, it is *not* alive, as it has stood here a matter of some centuries This obelisk is one of the two that originally stood at Heliopolis, and it was brought here to Alexandria in the reign of Tiberius, A.D. 14, and set up in front of the temple of Cæsar, or the "Cæsarium," which the Alexandrians of that day had erected in honor of the emperor. Another account indeed assigns the erection of this temple to Cleopatra to commemorate the birth of a son by her to Julius Cæsar, and, if this story were true, it would explain the origin of the traditional name; but most authorities unite in saying that the former

account is true, and that Cleopatra had nothing to do with this monolith. It is of red granite, from Syene, is about 70 feet high, and the diameter at the base is 7 feet 7 inches. It was standing, until a few days ago, on the sea-shore of what is known here as the New Port, amid a lot of stones, sand and rubbish, and utterly neglected. In appearance it is a poor, wretched, battered out old stone. The hieroglyphics once carved on it are greatly worn, and on one side, mostly are obliterated by the exposure to the sea air, and, except by those who are enthusiastic about such curiosities, it would be considered unworthy of removal. It was entirely neglected by the people here, yet, when they found it was given away to New York, they got greatly excited over it, and petitions were circulated and extensively signed to the Egyptian government to prevent its removal; but what had been promised must be given, so the efforts to stop its removal were useless. After some difficulty, the stone was overturned about ten days ago, and is now being lowered at the rate of twenty inches a day into a wooden boat to be built around it, and, when down and boxed up, is to be launched and towed around to the Old Port, where it will be shoved into the steamer Dussuk, which the contractors have bought of the Egyptian government for £5,100. It is hoped to have it in the steamer and ready to start to New York by the middle of February, but the wise ones here say it is not so easy to move such an immense weight; so don't look for it much before the summer—in time for it to *celebrate the Fourth.*

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Turning aside from business for a moment, with a promise to write again, let us say a few words to the invalid and broken down man of business of America about this wonderful climate. The bane of the climate of eastern North America is, without doubt, its sudden changes, and all your doctors will advise you to search for that much-to-be-desired place, not cold nor warm, but where the temperature will remain constant; and we state, without fear of contradiction, that Egypt is the only country in the world that has so steady and constant a temperature. All during the long summer months it stood constantly at 80° F., with a constant, cool breeze that made it feel like 70° F. at home. Sometimes we would look at the thermometer and shake it, and say, "Surely, it must be wrong." No; there it would stick, morning, noon and night, at 80°, and not budge a hair's line. And later on it went gradually down, down to 70°; then to 65°, and kept to that for weeks; and to-day, and for days back, it is still at 65°, at noon, and 60° night and morning. It has never been below 56°, and that only for a few hours; so that expressions like "rainy," foggy," "frosty," and "dull" are never known in the Egyptian vocabulary, for we have no rain to speak of, nor fog, nor frost, nor dullness. So Egypt, for the sojourner in quest of health, or seeking a change for an overworked mind, cannot be equaled. To find that he can enjoy daily a cloudless sky and the open air, and under the most favorable circumstances, is a cure in itself. Besides, we have pleasant, cheerful cities, that are every year assuming a more and more European look, yet still have the attractions of the Oriental life and the curious costumes of the natives. We are but three days, by

splendid steamers, from Brindisi, Italy, and but five days from Marseilles, France, which is but twelve hours' rail from Paris. Yours truly, L.

—*Correspondence Boston Journal of Commerce.*

METALLURGY.

UTILIZATION OF BLAST-FURNACE SLAG.

Of all the waste substances for which modern science has found a practical use, none could well seem more hopeless than the slag from blast furnaces employed in the smelting of iron. It was even more unpromising than the "tar" of the gas manufactories, which has been so often cited as a striking instance of the utilization of a waste product long regarded as a nuisance, to be got rid of only with much labor and expense. In the iron districts of Great Britain this slag has been accumulating at the rate of millions of tons every year. Hundreds of acres of land have been sacrificed as dumping ground for it, and in some localities the iron-masters have been at their wits' end to find more room for the purpose. In a few cases, as at Barrow, it has been possible to tip it into the sea, and thus make new land; and on the Tees some six hundred thousand tons a year have been absorbed in breakwaters for improving the navigation of the river. But, as a rule, the slag has been an elephant on the hands of the manufacturers, bulky and costly to dispose of.

Now, however, several industrial uses have been discovered for this *bete noir* of the furnace proprietors. An inventor, named Wood, has succeeded in converting the slag into sand, as it is run from the blast furnace. From this sand, mixed with a certain portion of selenitic lime, he manufactures bricks, which possess many advantages over the ordinary bricks of commerce, and are gradually finding a market for constructive purposes. Mr. Wood likewise utilizes this slag sand in the manufacture of concrete, cement and mortar. The works at Middlesbrough, where the manufactures are carried on, are constructed of this concrete, and speak well for the new material. By reducing the slag to a fibrous condition, Mr. Wood has also produced a material which is usefully employed as a non-conductor of heat in clothing steam pipes and boilers. This substance, which has been named "slag wool," or "silicate cotton," from the resemblance it bears to cotton-wool, is perhaps the most striking result of his investigations.

Another direction in which slag is being utilized is the manufacture of glass bottles, and the glass railway sleepers, to which reference has already been made in the *Journal*. To Mr. Bashley Britten commerce is indebted for the first-named development of glass manufacture, and there are works in Northamptonshire where the slag of the iron ores of that county is now being converted into glass bottles, which are said to be superior to the ordinary flint bottles for strength.

The glass sleepers are toughened, as we have before stated, by a new process, the invention of Mr. Frederick Siemens, of Dresden. Some of them have been lately laid on the North Metropolitan Tramway system at Stratford, where they are subject to exceptionally heavy traffic, and have thus far stood remarkably well.

The most recent advance in slag utilization has been made by Mr. Frederick Ransome, in producing a pure white cement of greater strength than the best Portland cement.

A wide field is opened for turning all these inventions to account; and the progress of science and the fertility of invention will probably lead to yet further developments in the same direction. The supply of raw material is not likely to give out, as the present production of slag in Great Britain is estimated at eight millions of tons yearly, to say nothing of the immense "mines" of it to be found in the accumulations of past ages.—*Boston Journal of Chemistry.*

COLORADO GOLD AND SILVER PRODUCTION IN 1879.

A special telegram to the New York *Times* gives the production of Colorado by counties as follows:

"Lake County, $11,477,046; Gilpin, $2,608,055; Clear Creek, $1,912,410; Boulder, $800,000; Custer, $720,000; Park, $434,749; Gunnison, $300,000; Summit, $295,717; Chaffee, $71.240; San Juan country, $483,500. Total, $19,110,882. In 1878, it was $9,820,743.12, showing an increase in one year of $9,290,118.88. Lake County shows the enormous increase of $8,759,665.99. Clear Creek and Park counties are the only ones which do not show an increase. While speaking of the Leadville yield, it may be stated that the total of ores treated by smelters for the year 1879 is 110,483 tons, realizing $10,504 106, or a value in pure silver and metallic lead of $95 per ton. This is certainly the largest average value of silver ores in bulk and the greatest production ever known in any camp of its age in the world's history of silver mining. The gold product of the Harrison smelters, amounting to $12,940, has not been included in the above table. This increases the commercial value of the product to $10,517,046. The 21,349 tons of bullion have, therefore, an average value per ton of $492.62½. For the 365 days of the year, the daily consumption of ore by our smelting establishments has been 305 tons, producing 58½ tons of bullion each twenty-four hours.

"The numerous producing mines have much ore on hand, and all the milling establishments carry stocks which, by the most painstaking and conservative estimates, are reckoned at 12,000 tons, at an average value of $90 per ton. This must be added to the smelting product to show the gross mining outputs in ore and the value in dollars for 1879, reaching a grand total of 122,483 tons of ore mined out of the ground, and representing a value of $11,477,046. The ore mined during the year has at no time exceeded 700 tons daily, and has occasion-

ally fallen as low as 150 tons per day. The average for each of the 365 days of the year has been a little over 335½ tons, worth $93.73 per ton."

The Leadville *Chronicle* says that it is stated that Mr. W. H. Stevens is now negotiating with Flood, Mackay & Co., the Pacific coast bonanza kings, for the sale of his half interest in the Iron mine, Mr. Stevens' price being $880,000 cash. Flood, Fair and Mackay are undoubtedly prepared to transfer their capital and energies to the Colorado mining field, but we do not believe that they will here repeat the history of their operations on the coast.

SCIENTIFIC MISCELLANY.

THE TAY BRIDGE.

This bridge, which broke down on the evening of the 28th of December, and precipitated a train of the North British Railway into the river below, was one of the most important engineering works in Great Britain. It was commenced in 1871, and finished in 1877, in the face of unusual difficulties, by Sir Thomas Bouch. It comprises eighty-five spans, and has a total length of 10,321 feet (or nearly two miles). The reports of the disaster to the bridge, given in the daily papers, state that twelve spans gave way and dropped into the river. The cause of the accident has not yet been ascertained with certainty, opinions being divided as to whether the broken portion of the bridge was carried away by the hurricane that was raging at the time before the train entered upon it, or whether it broke under the load of the train. The legal investigation of the accident, which is to take place, will, no doubt, ascertain the true state of the facts. Meantime, it will be of interest to notice that the official test of the structure, which was made before it was opened to traffic, was pronounced to be entirely satisfactory by the best authority in the United Kingdom. *Engineering* spoke of it as follows:

"The result (of the official test) is the complete establishment of this fact, so important to the public, that the bridge is strong out of all proportion to its possible necessities. As a matter of fact, the load which the structure is calculated to carry is six times greater than that to which it was subjected by General Hutchison."

The constructor of the bridge is reported to have stated, as his opinion after an inspection, that the accident could only be accounted for on the supposition that the train ran off the track, and thus tore the structure to pieces. A thorough investigation of the cause of this grievous disaster is rendered the more imperative, as another bridge of the same kind has been contemplated over the Frith of Forth.

THE DUKE OF ARGYLE ON AMERICAN SCENERY.

The Duke of Argyle, who is publishing his impressions of America in *Frazer's Magazine*, steps gracefully out of the line followed by ordinary tourists in portraying the beauty and grandeur of Niagara Falls. He is too much of a scientist not to take in the scientific aspects of that magnificent bit of scenery. Its geology is succinctly but not pedantically reviewed, and he fully subscribes to the orthodox geological belief that the gorge below the falls has been cut by the action of the cataract itself, which has receded from Queenstown to its present position. He explains why this particular gorge should be considered as the work of the mighty torrent now flowing through it, while the rule that streams have excavated their own beds is not generally admissible. He dips gently into the hackneyed question of the time necessary for the execution of such an amount of work by such an agent, and concludes that the time when the cataract started from Queenstown was, geologically, not very ancient. In all this he follows substantially, though with a pleasing personality, in the track of other scientific visitors to the falls.

But he was informed that from Brock's Monument, at Queenstown, there was a "fine view," and, proceeding to verify this information by a visit to that historic locality, he found, as he says, a fine view indeed. As his eye swept over the scene before him, his æsthetic nature asserted itself, and he surrendered himself entirely to the enjoyment of what he describes as one of the most impressive landscapes he ever beheld. He remarks that the rivers of America are so large that they resemble lakes without their placidity, and that its lakes are so large that they resemble the ocean without its grandeur. But here, from the high bluffs at the head of Lake Ontario, was spread before him a landscape in which these features were so displayed as to efface their ordinary incomprehensibility. Straight before him the blue water of the lake stretched to the horizon, forming a sky-line. To the right and left, the American and Canadian shores trended away until lost in the blue distance, while the spire of many a neat village, shooting up from amid massive clusters of foliage, lent an additional charm to the superb natural beauties of the scene. To the left was presented one of those great reaches of country, which his eye was able to grasp as a whole, and rob of its oppressive immensity. So far, he shows a fine appreciation of the beautiful; but the æsthetic has its scientific side, and he saw also the lanscape's possibilities.

Up at the head of the gorge, the Niagara is pouring its ceaseless volume down into a recess where the effect is lost because of the contracted field from which it can be viewed. The grandeur of the fall is in a measure estimated instead of felt. The water disappears, but whither can only be ascertained by peering over the banks which confine it. But when the falls were at Queenstown, tumbling out boldly from the bluffs of the lake, their effect must have been grand and beautiful beyond anything which we can now conceive. Instead of plunging into the bowels of the earth, as it were, they flashed out into the pre-glacial sunlight, a salient instead of a hidden feature of nature. The landscape was a setting every

way worthy of such a gem; and what a wonderful charm such a gem must have lent to the landscape. The great cataract, which is now perceptible only in detail, was then visible as a whole from every conceivable point of view. Not only in the shadow of its own mist, but afar off on the bosom of the great lake its effect could be studied.

The Duke, we believe, is the first one to grasp the superiority of the original cataract of its present representative. Tourists of every shade of culture have studied the falls at their leisure, and if there was anything which had come to be taken for granted, it was that nothing new could be written about them. Yet here is a man, writing *currente calamo*, who presents their former superior glory so naturally that it is a wonder no one ever thought of it before. The "fine view" from Brock's Monument is now transformed into a landscape, over which the future tourist may gaze and mournfully reflect that he lives at least forty thousand years too late. The comparatively unevolved man of four hundred centuries ago saw a Niagara of which the present is but a feeble imitation. What a great pity the rocks of the Queenstown bluffs were not gifted with an imperishability that would have preserved the ancient cataract unimpaired. But, since that was impossible, what a pity that the Duke of Argyle has made known to us such a great misfortune.—*Globe-Democrat.*

THE WIND EXPOSURE OF BRIDGES.

Mr. Gilkes, one of the engineers of the Tay bridge, estimates—in a paper on the structure, published in 1876—that the wind surface of the span was 800 square feet, that of the truss 800 feet more, and that of a train 800 feet in addition. An experienced bridge constructor in St. Louis informs us that an American bridge of 245 feet span exposes 9½ square feet to the running foot, or 2,327 square feet per span, and that the wind surface of a train is 10 square feet per running foot, or 2,450 square feet per span of 245 feet. Here, then, we have a wind surface of 4,777 square feet, or three times that calculated by Mr. Gilkes; and, as American bridges are more skeleton-like than the English, it is certain that the real wind surface of the Tay bridge was rather more than less than this. But, assuming that the wind snrface exposed was the same as that of an American bridge of the same length of span, we have, at thirty pounds of wind pressure per square foot, a force of 143,100 pounds, acting with a leverage of 98 feet in the effort to overturn span and pier. The upward force, therefore, at the point of junction of the brick and iron piers would be, when combined with the wind pressure on the pier itself, 538,000 pounds, as against a downward weight of half the span, train and pier—417,000 pounds, or 121,000 pounds of tension in the windward column. If this column was of cast-iron, we need go no further to find the cause of the accident. A force of 30 pounds per square foot has been assumed because 31 pounds per square foot will overturn a passenger train.

Nor is the Tay bridge singular in this special weakness. Out of twenty-three

bridges illustrated in *Humber's Iron Bridge Construction*, there are only four that have any wind bracing whatever. These are English bridges. In America in the last ten years there have been blown down no less than four important structures- First, eleven spans of 255 feet each of the bridge over the Susquehanna, at Havre de Grace; next, two spans of 160 feet each at Decatur, Alabama; next, two spans of 250 feet each over the Missouri at Omaha; and, lastly, three spans of the bridge on the Wabash road at Meredosia. All of these accidents were due to weakness of portal and wind-bracing, and the country is full of bridges which are equally defective, and which will fall when exposed to the same forces.

These accidents have borne good fruit. For instance, the bridge specifications of the Chicago, Milwaukec and St. Paul, and those of the Cincinnati Southern Railroad, which are the most stringent yet adopted by engineers, require that all structures shall be proportioned to stand a wind stress of thirty pounds per square foot on both the train and all exposed surfaces of both trusses of the span on which it stands. This is making a commencement toward curing the evil. The old practice was to consider only *one truss* as the exposed surface, and this is evidently still the English custom, as is shown by the method adopted by Mr. Gilkes in computing the wind surface of the Tay bridge.

Evidently there is ample work for the proper officials of the various railroads in making a thorough examination of their bridges built prior to the last three years, and having the wind-bracing of these structures brought up to the proper standard.

THE NAVAL OBSERVATORY LIGHT.

For some years the officers of the Naval Observatory, at Washington, have suffered very seriously from the malarial influences arising from the Potomac River, which runs at the base of the hill on which this astronomical institution now stands. The present site is invested with many historic associations. It was here that Braddock, when leaving Alexandria, landed his troops to take up the march for the fatal field of the Monongahela, in 1755, and it was a project of Washington's to establish here a National University, and in 1813 and 1814, during the British invasion, the American army was encamped here. On these accounts, the site has been maintained, but the changed physical conditions of the Potomac River now render the place so absolutely uninhabitable that Congress, after several years' persistent effort, has come to the conclusion that another location should at once be selected, and, instead of passing a measure directing some committee to select a new site and report to Congress, as heretofore, the present bill authorizes the appointment of a commission of three persons, one from each of the naval committees of Congress, and the third to be selected by the Superintendent of the Naval Observatory. Seventy-five thousand dollars is appropriated for the selection and purchase of a site. The rank of the Naval Observatory now stands on an equality with the famous observatories of Greenwich, Paris

and St. Petersburg. The astronomical observations of the last few years, especially that of the transit of Venus, have contributed to give this institution a high position in the scientific world.

THE ORIGIN AND DESTRUCTION OF THE WORLD.

Prof. Rudolph Falb, a distinguished scientist and savant of Vienna, Austria, recently delivered a learned discourse on the Origin and Destruction of the World. The lecture was altogether scientific, and was couched in the nost recondite and technical phraseology of science.

Beginning his subject, he propounded the following ten questions and propositions, which formed the substance of his discourse and were analyzed in detail: 1. What was the beginning of all things? 2. The sun is the mother of the earth; all the planets were born out of the sun millions of years before this. 3. How the elements producing light in the sun and stars are discovered. 4. Origin of the sun. 5. How the starry world is built. 6. The moon originated from the earth. 7. The interior of the sun. 8. What would be the consequence of the sun and moon approaching the earth? Is it possible for comets to come in contact with the earth? and, if so, what would be the result? 9. Will the world be destroyed by fire, water or drouth? 10. How scientists and astronomers anticipate what the end of the earth will be.

Taking up each question, the lecturer explained and answered them in minute detail, following up the origin of all things, the world, sun and stars, as by fire, and their duration to the end of the universe and all things that exist, animate and inanimate. The Professor believed that the earth would be destroyed by fire, and that every atom would separately form the nucleus of a new world.

ARCHÆOLOGICAL DISCOVERIES IN CLAY COUNTY, MISSOURI.

Mr. F. W. Putnam remarked on the character of the shell-heaps of the Atlantic and Pacific coasts of North America, comparing them with Japan, and alluded to the importance of a comparative study of the shell-heaps in various parts of the world. He then stated that it would be of interest to the members, in connection with the discovery of dolmens in Japan, as described by Professor Morse, to know that within twenty-four hours there had been received at the Peabody Museum a small collection of articles taken from rude dolmens (or chambered barrows, as they would be called in England), recently opened by Mr. E. Curtiss, who is now engaged, under his direction, in exploring for the Peabody Museum.

These chambered mounds are situated in the eastern part of Clay County, Missouri, and form a large group on both sides of the Missouri River. The chambers are, in the three opened by Mr. Curtiss, about eight feet square, and

from four and a half to five feet high, each chamber having a passage-way several feet in length and two in width, leading from the southern side, and opening on the edge of the mound formed by covering the chamber and passage-way with earth. The walls of the chambered passages were about two feet thick, vertical, and well made of stones, which were evenly laid without clay or mortar of any kind. The top of one of the chambers had a covering of large flat rocks, but the others seem to have been closed over with wood. The chambers were filled with clay, which had been burnt, and appeared as if it had fallen in from above. The inside walls of the chambers also showed signs of fire. Under the burnt clay, in each chamber, were found the remains of several human skeletons, all of which had been burnt to such an extent as to leave but small fragments of the bones, which were mixed with the ashes and charcoal. Mr. Curtiss thought that in one chamber he found the remains of five skeletons, and in another thirteen. With these skeletons there were a few flint implements and minute fragments of vessels of clay.

A large mound near the chambered mounds was also opened, but in this no chambers were found. Neither had the bodies been burnt. This proved remarkably rich in large flint implements, and also contained well made pottery and a peculiar "gorget" of red stone. The connection of the people who placed the ashes of their dead in the stone chambers with those who buried their dead in the earth mounds, is, of course, yet to be determined.—*From the Proceedings of the Boston Society of Natural History, Vol. XX, Oct. 15, 1879.*

UNDERGROUND TELEGRAPHS IN FRANCE.

M Cochery, the Minister of Posts and Telegraphs in France, recently applied to the government for a credit of 8,000,000f for the establishment of subterranean telegraph wires along some of the main trunk lines, to take the place of the existing aërial lines, should the latter become incapacitated by the weather, or by any other cause. The total length it is proposed at present to lay is 295 kilometres.

A STORM DETECTOR.

Professor A. Mayer, of the Stevens Institute, U.S., records that while a thunder storm was raging at so great distance off that only the illumination of the clouds told when a flash occurred, he attached one wire of a galvanometer to the water-pipes and the other to the gas-pipes of his house, thus connecting in metallic current a vast system of metallic conductors stretching all over the city. Whenever a flash occurred, he states that the galvanometer needle was deflected ten to twenty degrees. The two occurrences were simultaneous, so far as could be determined. The storm was twelve miles distant, and the conclusion drawn was that "at least 500 square miles of the earth's surface had its electrical condition changed at each flash of the lightning."—*Telegraphic Journal.*

THE RED SPOTS ON JUPITER.

Recent communications to the *Astronomische Nachrichten* give further interesting details of the large, oblong red spot, which may at present be seen on the southern portion of Jupiter's disc. According to Th. Bredechin, of Moscow, it is 16 seconds of arc long and 4 seconds broad, and lies about 9 seconds south of Jupiter's equator. It is surrounded with very brilliant white faculæ, which are especially conspicuous on its southern border.

According to Dr. Lohse, who has observed the spot since last June, it appears to lose, in a considerable degree, its intensity and color when near the planet's limb. He also sees the faculæ, spoken of above, and remarks at the preceding end of the spot a sort of grayish continuation, resembling in form an inverted comma.

This spot has not apparently diminished in intensity or size during many months—a fact which indicates considerable stability. As there is considerable probability that it will be visible another season, Dr. Lohse suggests that observations of its position will afford very valuable data for an accurate determination of Jupiter's rotation period. The sharpness of outline and regularity of form of the spot admirably adapt it for this purpose. The position of the spot should be fixed by estimation, its distance from the planet's limb being expressed in parts of the parallel of latitude passing through the spot; that is, in parts of the chord of the planet's disc drawn through the spot parallel to Jupiter's equator. Either end of the spot may be used for this purpose. The estimation made when the spot is near the center of the disc will be manifestly the most certain.

This is an opportunity that amateurs should not neglect, since the observation can be made with moderate telescopes and without a micrometer.

—*Science Observer.*

ENGLISH WEATHER FOR 1879.

Since the great storms that carried death and destruction into almost every section of the British Islands, between the 27th of December and January 2, the English newspapers teem with meteorological tables and articles, all of which go to prove that our friends on the other side of the Atlantic have passed through one of the most disastrous agricultural seasons ever experienced. Comparisons have been made as to the rainfall of 1869 with that of sixty-four years back, and it was found that during the first nine months of the past year no less than 29 inches of rain fell, while the nearest approach to that amount was in 1828, and then it was 2.5 inches short. During the quarter ending with September, rain fell in 53 out of 78 days, the total amount being 11.75 inches. In April, May and June rain fell almost constantly, and the sun was but rarely seen. The month of July was the most remarkable on record, rain falling every day during the first half of the month, turning to snow in some districts on the 4th, 8th and 9th. August brought

a change for the better, and agriculturists began to think their misery was over. They were doomed to disappointment, however, for, although the middle of the month was all that they could desire, a sudden change took place toward the latter end, and at its close all hope of saving even a moderate harvest was blasted. September was not remarkable for its fine weather. No rain fell during the first week, but the month was in every way similar to the preceding ones. The people have one consolation in learning from the scientists that have examined into the matter that they are very unlikely to experience a recurrence of such a dismal season for many years to come, for, as the tables of averages show, there is a gradual improvement of the climate of England in respect to temperature, notwithstanding the want of warmth that marked 1879.

RECENT OBSERVATIONS OF THE SUN'S SURFACE.

Observations made by M. Henry, at Perlermo and Rome, during the second quarter of last year, indicate a certain increase in the activity of the solar surface over the first quarter, in the greater number and size of the spots and protuberances. There is also a difference in the relative distribution of the protuberances, which, during the second quarter, were nearly equally distributed over the northern and southern hemisphere, while in the first quarter, on the contrary, they were nearly all situated on the northern hemisphere. During the second quarter the maximum frequency in each hemisphere was between the parallels 30° and 50°, with none at the poles. This distribution is similar to that which prevailed during the first nine months of 1878. In the last quarter of 1878 and the first quarter of 1879, however, many more protuberances were observed in the northern than in the southern hemisphere. M. Henry considers this phenomenon as characteristic of the minimum of solar activity. The maximum frequency of faculæ appears to lie between 10° and 30° in each hemisphere.

M. Henry thinks his observations show that the minimum of solar activity was passed about the beginning of last year.—*Science Observer.*

THE ELECTRIC LIGHT AT THE BRITISH MUSEUM.

The reading-room of the British Museum is now lighted by electric lamps, and London journals give enthusiastic accounts of the new method. The following is from *Iron*, just received:

"The practical utility of electric lighting was fairly tested on Saturday morning, during the heavy fog which shrouded the metropolis. For more than a century readers at the British Museum have been compelled to suspend work on the occasion of a fog, and to leave the reading-room. But on Saturday morning, shortly after ten o'clock, when many readers, unmindful of the improvements of the age, were about to quit with their papers, the electric light was turned on, and,

without any apparent preparations, the spacious room was suddenly illuminated as by a magic ray of sunshine, to the great satisfaction of all present. There was a murmur of applause. For, with the new carbon which Messrs. Siemens have manufactured at their Berlin works, and with the gilt reflectors suggested by Mr. Bond, the principal librarian, the light is about as good a substitute for sunlight as can yet be desired.

"Since the latter part of October, the electric light has been continuously used in the national reading-room of an evening until seven o'clock, and an average of more than two hundred students and literary men have been nightly able to proceed with their researches to that hour, instead of leaving off, as formerly, when the shades of evening fell. It is reported that one of the staff, Mr. Nichols, has worked closely two hours daily for a fortnight by the light, with a view to try the effect on the sight, and finds that there is not only no inconvenience, but that the optic nerve is strengthened and that glasses are quite unnecessary as a protection."

THE ELECTRIC LIGHT IN THE GERMAN ARMY AND NAVY.

The *Year-Book for the German Army and Marine* states that the electric light has been empl yed for military and naval purposes—among others, for lighting up the ground lying in front of a besieged fortress, for the illumination of ships at sea, and, notably, for carrying on work under water. A transparent bell with an electric lamp has been immersed to a depth of 60 meters, while a magnetic electrical machine, placed at a distance of 100 meters, has been able to maintain a strong, unbroken current, so that a brilliant light was maintained for a long time. The same authority states that experiments are now in course of being carried out for the purpose of testing how far the electic light can be usefully employed in marine warfare, and especially as a defense against torpedo attacks.

HOW SMELTING IS DONE IN LEADVILLE.

The methods of obtaining the precious metals contained in ores can, in general terms, be classified into two—one crushing and amalgamating, an operation called milling; the other, the fusing of the entire mass of ore and separation of the pay from the slag and iron by operations depending upon the specific gravity of each. The former method is the one applied to gold ores altogether, and to such silver rock as is wanting the presence of lead, a production of nature that—ignoring the metallurgical terms in existence, which are seldom used—destroys the effect that quicksilver has upon silver and gold in separating it from the rock after crushing has freed it. Milling is the process used in the treatment of the quartz found in the Comstock lode, but some of the Comstock ores require a preliminary introduction to a roasting or matting furnace, and, in some instances, demand the

presence of chemicals before they will release their hold upon other mineral affinities to accept the embraces of the quicksilver.

Smelting has long been in use in iron works in Missouri and New York, and in pig lead manufactories at Lake Superior, Utah and other less noted points, and suggested the idea to silver mine owners, who had found that the long used milling process was without effect.

The ores of Leadville are noted for three qualities seldom seen traveling hand in hand—very rich mineral, mined with ease unprecedented, and reduced at a trifling expense compared with smelting in other localities. The *modus operandi* in use here can be made clear by a description of either one of the numerous extensive works now in operation.

The fusion of the rock is the same in every establishment, but the many details attending the movement of the rock and appurtenances looking toward convenience are brought to varying degrees of perfection in different works. The furnaces in use are what are known as "water jackets." The floor of the stack is constructed of cement, clay, and material calculated to prevent the seepage of the mineral into the ground. The "water jacket" is constructed of very heavy iron, and has a diameter of probably five feet and a height of six feet. Within this the molten metal separates according to specific gravity. The iron jacket is kept from succumbing to the terrible heat by the continual circulation of water between the inner and outer plates that compose it.

Upon one side, and having a connection with the molten mass near the bottom of the furnace, is the lead well, or place from which the bullion is dipped into iron moulds. The pressure of the charges above forces the bullion into the well, keeping it full at all times; but care must be exercised lest so much be dipped out that the slag will assume its place. In ordinary works two front spouts are used, one for iron—the lower one—and the other for slag; but, owing to the ease with which Leadville ores are separated, only the latter is here used, both iron and slag being drawn from it.

Resting upon the "water jacket," and supported by pillars, a brick flue, of a foot or more larger diameter, extends for twenty-five feet, when it converges until an ordinary sized smoke-stack is reached. Each fire has a blower which fans it through five tueres, two on each side and one behind.

The prime element conducive to success is a proper mixture of ores; that is, some mineral contains sufficient lead to fuse but lacks the iron necessary to flux it, no one rock, as a general thing, containing all the ingredients arranged in proper quantities. Hence the demand for good judgment and experience on the part of the purchaser. Oftentimes a price in advance of the amount that can be taken from the rock is paid to secure one ore carrying the factor needed to assist in smelting another class.

In the same manner the quantity and sort of fuel must be regulated from experiments in the laboratory and from practical workings of the furnace. The feeder's is the responsible position, as, although another brain plans the ingredients of

the charge, and other hands mix it, upon him rests the duty of properly distributing it in the furnace and at the proper time. His position is one subject to the great evil in smelting—getting "leaded"—and the good wages he receives are well earned by the danger he is constantly incurring.

A furnace is run night and day. To allow it to cool down, would entail a heavy expense in drilling out the mass of iron and slag that would have to be removed. Charcoal and coke are the only fuels used, the latter being obtained principally from the east at an expense of about sixty dollars per ton, and the former is worth eighteen cents per bushel.

The bullion, as shipped, contains about four hundred ounces of silver to the ton, and each furnace yields from six to ten tons per day, the result of from twelve to twenty tons of ore.—*Carbonate Chronicle.*

PENETRATIVE POWER OF THE ELECTRIC LIGHT.

Some time ago an experiment was made in New York State to test the distance at which the electric light would illuminate a given spot, and it was found that a concentrated beam carried seven miles furnished enough light to read by. A more crucial test of the great penetrating power of the electric light is furnished by the experiments of the officers of the French Algerian Triangulation Service, who recently saw the electric light from the Spanish station of Zetica, from a distance of more than 164 miles. This observation is proof, if proof were wanted, of the great value of the light for maritime purposes, when it is exhibited from sufficiently elevated positions.

In a lecture delivered at Berlin, on Electricity in Service of Life, Dr. Werner-Siemens spoke of the problem of electric transmission of power to a distance. He stated that two cases of the kind existed in the city. In one case looms were driven, and in the other a small locomotive. He also insisted upon the value of electricity for metallurgical purposes, and thought that the solar rays may by-and-by furnish all necessary fuel through the agency of the electric current.

Palmetto fiber, it is now said, makes an excellent article of paper, and machinery has been set up at Fernandina, Fla., for experimental purposes in this line.

Robin has confirmed, by new experiments, his discovery that the electric organ in the tail of the ray acts like that of the torpedo and gymnotus, the differences being merely of a secondary nature.

A glass manufactory in Hanover, Germany, makes glass which is a close imitation of marble, and tables and floor tiles which are pronounced preferable to marble on account of their extreme hardness.

Dr. Tellef Dahll has isolated a new metal from a sample of copper-nickel, and calls it "Norwegium." It is white, with a brownish tinge, and in hardness resembles copper. The melting point is 350 degrees centigrade, and specific gravity 9,441.

BOOK NOTICES.

THE PHILOSOPHY OF THE SCIENCES. By J. M. Long, A.M. Chillicothe, Missouri; 1879.

The author of the above named work is Professor of Physiology in Richmond College, Missouri, a man of learning and culture, who has had the courage to undertake, not only the writing, but the publication of a Classified Scheme of Knowledge, arranged especially with reference to "right methods of instruction." The work is not yet completed, but we have been favored in advance with a few pages, which sufficiently indicate the general object and course of the writer. Part I is devoted to Preliminaries; Part II to Categories of Sciences, *i. e.*, Quantity, Motion, Force, Organism, Mind, and Being; Part III, Statement and Application of Organizing Law, as to Cosmology, Andrology, and Ontology, with Bearing on Right Methods of Instruction.

As illustrative of the author's style and the ground-plan of the work, we quote briefly:

"The entire body of Science constitutes an Organism, in which all the related parts exert a reciprocal influence on one another. All the branches of Science are so mutually dependent that one part cannot advance without the advancement, to a certain extent, of all the others. This reciprocal influence is shown in two ways, in *data* and *method*. The entire history of Science furnishes illustrations. Thus terrestrial mechanics furnished the data for celestial mechanics, while this reacted on the former by embracing its phenomena in the universal law of cosmical space. The concept of force as manifested in the interactions of masses has unfolded into the higher conception of the interaction of molecules, and thence by a still higher unfoldment into the all-pervading *ether*, the sole function of which is motion. Molecular physics has furnished important data to chemistry, while both these sciences have united to raise physiology to the rank of a science. Biology has also furnished important data to Sociology, the science of human society. So intimate is the relation between these two sciences that the study of socio-

logical problems, independently of the data furnished in Biology, would be antiquated and far out of the range of the best thought on this subject. Sometimes one science furnishes important data to another in the form of analogies "

THE PROFESSIONAL SCHOOL IN THE AMERICAN UNIVERSITY. By Thomas Jefferson Lowry, S.M., N.G., C.E. Columbia, Missouri, 1879.

The above is the title of a very full and exhaustive lecture delivered by Prof. Lowry at the University of Missouri. Its object is to advocate the claims of Industrial Education in the State, and it covers the ground very comprehensively. We shall probably use portions of this excellent lecture for the benefit of the readers of the REVIEW in our next issue.

DOUBLE STAR OBSERVATIONS. By Sherburne Wesley Burnham, M.A. Chicago, 167 pp. quarto.

This work, and the necessarily vast amount of labor involved in taking the observations, making the calculations and recording them, give a strikiug illustration of what untiring industry, combined with natural fondness for a subject, can accomplish; for, as we are informed, Mr. Burnham is by profession a lawyer, and only makes Astronomy a recreation. His chosen department is that of double stars, and the volume under consideration comprises a list of hundreds of such double stars, discoved, measured and described by him in 1877–78. It is reprinted from Vol. XLIV of the Memoirs of the Royal Astronomical Society. The observations were made with the 18½-inch refractor of the Dearborn Observatory, which, when constructed, was the largest object-glass in the world. Prof. Burnham describes several simple but effective improvements made by himself for the handling of the instrument, reading of the vernier of the right ascension circle, etc. His indifference to the luxuries of some observers is characteristic. We note his remarks on the manner of observing:

"The Observatory is provided with no seat or couch for zenith observations. * * * For moderate altidudes I have used a step-ladder, making a tolerably comfortable seat by the simple expedient of placing a box on the step below, equal in height to the distance between the successive steps."

CHEMICAL HISTORY OF THE SIX DAYS OF CREATION. By John Phin, C.E. New York, 96 pp. 12mo; 50c.

This is a chemical history of the creation of the world, and is an attempt to reconcile the Mosaic cosmogony with that indicated by modern science, from the chemist's standpoint. The author claims for it that his theory "accords so wonderfully with the Mosaic account that it is at least impossible to say that in this matter science is in the slightest degree opposed to revelation."

Besides giving chemical proofs and illustrations in support of his theory, the author in several instances has strayed into other departments of science, but in

each instance it is for the benefit of the general reader. It is a very satisfactory little book indeed.

LETTERS FROM EUROPE. By Hon. W. D. Kelley. Philadelphia, 1879, Porter & Coates.

This pamphlet comprises six letters, written by the distinguished writer and statesman to the Philadelphia *Times*, during the summer of 1879, with notes since added. The principal object of the publication is to "shed light upon the question of bi-metallism, a question of grave and world-wide importance." But at the same time Mr. Kelly has succeeded in rendering it particularly interesting to the general reader by his remarks upon the eminent personages he met and the notable places he visited. His eminently practical turn of mind and utilitarianism have led him out of the ordinary track of traveling letter writers, and the result is a small volume of facts, observations and conclusions worthy of being preserved in any public or private library.

OTHER PUBLICATIONS RECEIVED.

We have received from Prof. Ormond Stone, of the Cincinnati Observatory, a chapter from the *American Journal of Mathematics*, Vol. II, 1879, entitled On the Dynamics of a Curved Ball, in which he points out and corrects an error made by Prof. Eddy in his paper on The Lateral Deviation of Spherical Projectiles.

Report of the Proceedings of the Thirteenth Annual Session of the Missouri Press Association, held at Columbia, Mo., May, 1879.—Atti della Societa Toscana di Scienze Naturali Residente in Pisa, Processi Verbali, Vol. II; Pisa, 1879.—Annual Statement of Live Stock Receipts and Shipments at the Kansas City Stock Yards; by E. E. Richardson, Secretary.—Inter-Oceanic Canal, by Prof. J. Lawrence Smith, Louisville, Ky.—American Entomologist, by Profs. C. V. Riley and A. S. Fuller, New York.—The Caterer, by J. Gilbert Smith, London, England.—The President's annual address to the Missouri Medical Association, May, 1879, by Prof. E. W. Schauffler, M. D.—How to learn Short-Hand, by Arthur M. Baker, S. R. Wells & Co., N. Y., 25c.

EDITORIAL NOTES.

THE lecture of Prof. J. T. Lovewell, of Washburn College, Topeka, upon Some Lessons from the Life of Faraday, delivered before the Kansas City Academy of Science, on the 13th ult., was an able, interesting and instructive discourse. The average attendance upon such lectures may be regarded as a fair test of the intelligence and literary tastes of any community.

The next lecture of this extra course will be delivered by Prof. F. E. Nipher, of Washington University, St. Louis, on the evening of Tuesday, February 17.

The regular meeting of the Academy was held at its rooms on the evening of the last Tuesday last month. Papers were read by Messrs. Coddington and Gilham, the first upon the Relation of Æsthetics to Industry, and the second upon Sanitary Engineering. Both of these papers were received with great favor and will be published in future numbers of the REVIEW. A general invitation to attend these meetings is extended to all, without charge.

IN the death of Hon. Alfred Gray, which occurred on January 22, the State of Kansas loses one of her most valued and trusted citizens. During the late war he was one of the foremost in tendering his services, and was an active and efficient officer in the 4th and 5th regiments of Kansas infantry. After its close he was appointed Secretary of the State Board of Agriculture, in which position he labored until his death. He was an excellent citizen and an intelligent, zealous and untiring worker. In our judgment, no one factor has contributed more to the rapid growth and progress of Kansas than the skillfully prepared, comprehensive and exhaustive Reports of the Agricultural and Mineral Resources of the State, prepared and distributed by Mr. Gray.

THE Executive Committee of the Kansas Academy of Science held a meeting on Saturday, the 17th ult., and adopted measures to erect a fitting monument to the late Prof. B. F. Mudge. A committee, composed of Judge F. G. Adams, of Topeka, Joseph Savage, of Lawrence, and Prof. Parker, of this city, was appointed with power to act. Manhattan has pledged one hundred dollars for the monument, and there are hundreds, doubtless, who would delight to honor this public benefactor by contributing to this fund. Col. Theo. S. Case has been appointed to receive subscriptions in Kansas City. As Prof. Mudge was well known to many of our citizens, and was highly esteemed by all, it is hoped that we shall be able to send forward a generous tribute.

SOME alleged professional wags in Congress took occasion a few weeks since to be witty over the communication in the December REVIEW, from Mr. J. Walter Fewkes, of Cambridge, Massachusetts, relative to the peculiar habits of certain marine crustaceans, and published their efforts in the *Forest and Stream*, of New York, much to its temporary enlivenment. Evidently they have heretofore mistaken their callings.

THE Kansas State Board of Agriculture, at its annual meeting, re-elected R. W. Jenkins, President, H. C. St. Clair, Vice-President, and Wm. Sims, Treasurer. The Board took action favorable to the holding of a State Fair at Topeka next fall. Prof. Snow was appointed State Geologist; Prof. E. A. Popenoe, Entomologist; Prof. Hawn, of Leavenworth, Meteorologist; Profs. John W. Robeson and J. H. Carruth, Botanists; G. H. Failyer, Chemist, and W. Popenoe, Auditor.

THE attendance at the University of Missouri is the largest ever known in the history of that institution, and it is successful in all

its departments, everything working in a degree highly satisfactory.

The Board of Curators, at a late meeting, passed a resolution of thanks to President S. S. Laws for his generous contribution of $500, the amount necessary to exchange the present telescope in use at the University for one larger and of a more approved pattern.

THE December number of the Kansas City REVIEW OF SCIENCE AND INDUSTRY has a very clear description and explanation of the explosion of Corle & Son's candy factory, in Kansas City, Mo., written from the editor's standpoint of investigation in chemistry. It is so clear, reasonable and indisputable, that we make room for the facts as he has elaborated them.

* * * * * *

We really think Mr. Case, the editor of the REVIEW, has done himself credit, and that the subject matter has been treated the most clearly of any that has come to our hand.

—*Boston Journal of Commerce.*

THE new span of the St. Charles bridge, on the Wabash, St. Louis & Pacific Railroad, has been completed. Trains are now crossing the bridge regularly. The work of rebuilding was accomplished in just one month from the time of the accident.

DISPATCHES state that on the 9th of January Portland, Oregon, was visited by the most severe storm known since the settlement of that country. The direction of the wind at the commencement of the storm was southwest, but later it veered to the south. But little rain accompanied the storm, though heavy clouds passed overhead during its continuance. The damage to property in the city was not less than $75,000.

THE KANSAS CITY REVIEW OF SCIENCE AND INDUSTRY comes regularly, and is as regularly read. We again express our high appreciation of its merits. We do not know of a scientific journal that has a more interesting table of contents than Mr. Case sets before his readers each month.—*Farm and Fireside, Dec., '79.*

SOUTHEAST MISSOURI is booming up as a sugar-producing region. Experiments there the past summer with the early amber cane prove that section to be admirably adapted to the production of sugar.

MR. CALVIN DETRICK for a number of weeks past has been experimenting on the preparation of an artificial fuel, composed of coal culm, and his experiments were of such a satisfactory nature that he has already secured letters patent upon the same. The value of Mr. Detrick's discovery cannot be estimated, for it will, at a small cost per ton, utilize the millions of tons of coal culm, which are now being annually wasted in the preparing of coal for market.

ADMIRAL AMMEN says of the interoceanic canal routes:

"The Panama route was carefully located at the request of the commission, and a line located at an elevation of 123 feet above the ocean, which will probably require an increase of four or five feet, as shown by the flood of last November. The cost of this route on a common basis for labor and materials with Nicaragua was more than fifty per cent greater, and will, in fact, cost more than double to execute the work.

"The Nicaragua route has in canalization 61¾ miles. The remainder is either lake or slackwater navigation in a river not subject to floods. The water supply is twenty times more than could be used in lockage. The elevation of the summit level of the canal is 107 feet, and that of the divide between the oceans 150 feet. The cost of the canal, as estimated by the civil engineer, without an allowance for contingencies, was $52,000,000, and the cost named by the Commission $100,000,000."

SINCE the first opening of the Kansas University as a State institution up to the beginning of the present college year, 1,702 students have been enrolled. Since 1873, thirty-three have graduated in the collegiate department. The present year opens with a larger attendance than ever before, the number of students enrolled, up to October 31, being 358.

We have received from Prof. F. H. Snow, of the Kansas University, a copious and comprehensive summary of the Meteorology of Kansas for the year 1879, prepared from observations made by himself and Prof. H. S. S. Smith, which will be published in full next month.

The Topeka Literary and Scientific Club, at its recent annual meeting, elected the following officers for the year 1880: President, Prof. John T. Lovewell; Vice-President, Miss Eunice A. Lyman; Secretary, Geo. S. Chase; Treasurer, J. Lee Knight.

"Canst thou not minister to a *mine* diseased?" is the present query of many a shareholder on the Pacific slope.

Prof. Swallow's lecture upon Evolution and Creation is concluded in this number of the Review, which will be a gratification to those who did not hear it and a relief to those who were misled by the accidental omission of the words "*To be continued*," at the end of that portion published in the January number, and supposed that it was given in full.

NOTES FROM PERIODICALS.

The *Journal of the Franklin Institute* commenced its one hundred and ninth volume with the January number, under very favorable auspices, its list of able contributors among scientists and engineers being largely increased and its support being such as to warrant an increased effort and expenditure on the part of the publication committee. As a technological magazine, it is without a rival in the country, while it also contains a large amount of information on the practical applications of science.

As we write, *Harper's Monthly*, which has been "new" for over thirty years, comes to hand for February, and, as ever, it brings a fresh and wonderfully entertaining table of contents. There is no periodical published in the world that, in the quality and variety of its articles, the excellence of its illustrations, its general tone, and the manner of its editorial management, equals this as a family necessity.

The Boston *Literary World* has just been burned out with the Osgoods, but, nevertheless, manages to come out promptly on time and as bright, sparkling and fresh as ever, filled with just critical reviews of all the new books, literary items of all kinds. Shakespearean notes, contents of all the leading periodicals, etc., etc. It is just such a fortnightly visitor as students, public libraries, and teachers need and will enjoy when received.

The *Science Observer*, edited by G. H. Elson and F. R. Kimball, of Boston, is devoted principally to astronomical articles, but has, during the past two years, given space to a number of very good articles on other subjects of scientific interest. It commences its third volume with the December number, and deserves a large patronage.

We are as often indebted to the *Scientific American*, and its comprehensive and well edited *Supplement*, for valuable articles reprinted in the Review, as to any other exchange we receive, and we know of no other paper that would replace it in the workshop, the factory or in the household as a chronicler of progress in mechanic arts, manufactures or popular science.

What the leading literary journals of the day are to the reader who wishes to keep abreast of modern progress in education, geography, history, and *belles-lettres*, *Van Nostrand's Magazine* is to experts and proficients in engineering; architecture, mathematics and technical science. Its contributors are among the best writers and most skilled engineers of the country, whether in the army or in civil life, and it ranks with the best periodicals of its class in the world.

New Remedies, published by Wm. Wood & Co., and edited by Drs. Castle and Rice, must be one of the most useful publications to the medical profession and trade that is to be found.

WITH the January number of the *Manufacturer and Builder,* Dr. P. H. Van Der Weyde relinquished its editorship, and the position is assumed hereafter by Prof. W. H. Wahl, of Philadelphia, a well known writer on scientific subjects, who is at present connected with the *Engineering and Mining Journal,* of New York. Dr. Van Der Weyde is to take charge of a new journal.

PROF. ROMYN HITCHCOCK has commenced the publication of the *American Monthly Microscopical Journal,* at 51 and 53 Maiden Lane, New York. It is a handsome, twenty-paged octavo, and, considering the ability of Prof. Hitchcock and his associates, and the very low subscription price ($1), it should have an abundant support.

THE Leavenworth *Times*, which is the largest and best daily newspaper in Kansas, sent to its patrons and exchanges an exquisitely printed and illustrated almanac for 1880, as an appropriate and acceptable New Year's memento.

WE regret to learn that the *Monthly Science Index,* commenced by E. and F. N. Spon, and which promised to be a very useful thing, ceased publication with the second issue.

Lippincott's Magazine comes to hand handsomely printed and illustrated, and filled with articles of absorbing interest to all classes of readers. It is rapidly assuming a leading position among the literary periodicals of the country. Its article on KansasCity as the future national capital, however, though containing some wholesome truths for us as Missourians, is sadly lacking in historical and commercial completeness, and it is to be regretted that so wide a circulation should be given it.

THE February *Atlantic* is an excellent number, containing, in addition to its new quota of 144 pages, a 24-page illustrated Supplement, giving a full account of the Holmes Breakfast, with the speeches, poems and letters of that very interesting occasion.

THE *Sea World* is the title of a handsome and well conducted weekly newspaper published at New Haven,Connecticut, and edited by W. B. Hopson and E. C. Baldwin. It is devoted to "the sea and the things which are therein," and contains a large amount of valuable and interesting information. Two dollars per annum.

THE *Cumberland Presbyterian Quarterly* is the new title of what has so long been known as the *Theological Medium.* It is now in its twenty-seventh volume, and is edited by the Theological Faculty of Cumberland University, at Lebanon, Tennessee. 128 pp. octavo, $2.00.

THE London *Journal of Science* will hereafter present its readers with a subject index to the leading scientific journals of Europe and America, paged separately from the *Journal,* and furnishing the scientific investigator with a convenient reference to all the discoveries and important researches in his own special science, and give the librarian a complete subject index to scientific periodical literature.

THE Lawrence *Daily Journal,* of January 1, 1880, presented its readers with sixteen folio pages of historical, commercial, educational and agricultural information, in very attractive shape and well illustrated. It cannot but afford the citizens and well-wishers of Lawrence gratification to note the progress thus recorded.

THE *Carbonate Chronicle* also comes out with a mammoth twelve-page edition, in which Leadville and its mining, smelting and commercial interests are fully set forth, with cuts depicting the city itself and various views of the surrounding country and special localities. The descriptions are particularly well written, and we have no doubt that this issue will have a wide circulation and corresponding influence.

Popular Science Monthly and the *North American Review* were unusually late in making their appearance this month,and we shall not be able to do them justice until our next issue.

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PALÆONTOLOGY.

MASTODON REMAINS FOUND IN JACKSON COUNTY, MISSOURI.

BY DR. F. A. BALLARD, INDEPENDENCE, MO.

The remains of a mastodon were known to exist in an old lick in the eastern part of the county, and this information having been conveyed to me by credible parties, backed by a fragment of a bone of the fore-leg, I thought it best to make a personal inspection of the remains. So in company with Mr. Tidswell and a guide, who knew the spot well, I went to the place indicated—some twenty miles east of here—and, upon inspection, found the road had been considerably washed, and numerous ruts, from a few inches to three or four feet, were found in very stiff, hard clay which apparently out-cropped just at that place, and no doubt formed the bottom of the lick, for such it had been, as a responsible person vouched for, in my presence. This clay overlaid a very thick bed of ferruginous sandstone and both the rock and clay were strongly impregnated with iron, as the color indicated. On the edge of the largest rut and on top of the ground I found the remains of what was supposed to be a log of peculiar kind of wood. What kind it was no one could tell, but a close examination showed it to be an enormous tusk in an advanced stage of decomposition, both by the action of the elements and the triturating and grinding process of wagon wheels, crushing the precious treasure every time they passed over it. One man declared that he had known "that 'ere log o' wood to be there nigh onto forty year, and hearn that a brute animal had died there." Others said that when it was first discovered, it was larger than any sapling found in that country anywhere. But the wood proved to be the monster tusk of a mastodon, and measured at the base (from the

imprint in the clay,) fourteen inches in diameter, or over forty-two inches in circumference, and as it lay *in situ*, twelve feet in length with a curve of probably two and one-half feet. At the distal end the tusk appeared to have been broken off and was all of four or five inches thick, and I judge there was at least a foot gone. Three feet of it were found in a state of preservation sufficient to bring home, a segment of which I gave to Judge West, who will exhibit it at the Academy

PORTION OF ULNA OF MASTODON, 53 POUNDS IN WEIGHT.

of Science. We found but one large bone, the ulna, a drawing of which is sent, with measurements. Other bones were found, presumably of the feet, but were . . soft condition and could not be handled. I think the drawing will illustrate bone better than description, as the measurements are correct, and sketched fr the picture taken of it. It is my intention to make more trips to the remains, and if possible, not wait for Gabriel's trump to arouse him from his slumbers, as the neighbors would do. I have the best wishes of the Hulse brothers, in the neighborhood, and others who are willing to render me all the assistance in their power. From the formation of the soil, I think I shall, during the coming summer have a rare treat for the scientists of Kansas City. I will keep the REVIEW posted in the discoveries as they progress from time to time.

ARCHÆOLOGY.

THE CONNECTION BETWEEN ARCHÆOLOGY AND HISTORY.

A. J. CONANT, ST. LOUIS, MISSOURI.

I am asked "whether it is the common understanding of anthropologists and archæologists that the pre-historic men of the Stone, Bronze and Iron epochs are, as Quatrefages states in regard to the Canstadt race, traceable continuously and connectedly 'through the entire space of time which has elapsed from the Quaternary period to the present day,' or that there is a gap between those of the Iron age and the pre-historic Egyptians, Chaldeans, etc."

As far as I am able to judge, I believe the statement of Quatrefages explains

the opinion of the best informed anthropologists, among whom the French savants stand, I think deservedly, in the front rank. But this opinion, I think, is only considered demonstrated beyond doubt as far as Europe is concerned. The antiquities of Asia and of the valley of the Nile have not been studied sufficiently to warrant conclusions and statements so positive concerning pre-historic man in those regions. The conditions in the latter country seem to have been so different as to cause the development of a civilization unlike anything found in Europe. We meet, in the valley of the Nile and on the Assyrian plains, long before the dawn of history, the remains of a civilization which astonishes us. This must be accounted for partly by the wonderful fertility of the soil. Take Egypt, for example. Here was a strip of territory shaped—as far as proportions of length and breadth go—like one of her obelisks, nine hundred miles long by ten miles in width, with a soil like that of our American bottoms, of exhaustless richness, and watered by the perennial flow of the Nile. When the first migrations took place from the central home in Asia, the tribe, or tribes, which first possesed this beautiful valley found nature producing spontaneously, almost, the needed fruits of the soil, and inviting them to tempt her bounty still further. The taste and habit for agriculture were speedily developed to a degree which required ages to accomplish in more sterile lands, and where men could derive their supplies more largely from the chase.

When Italy was known only as the home of a barbarous, savage people, what was afterward known as Greece was inhabited by scattered families and insignificant tribes, known as Dorians, Æolians, and the like, Egypt stood forth alone in the splendors of her achievements in learning, science and the mechanic arts. Even then education was the heritage of the masses. In the granite quarries are pictures of men with tablets keeping account of the labors of the workmen. The French, in their explorations, discovered a tomb dating 1700 years before Christ, and inscribed to "To the Chief of Books," showing that at that remote period Egypt had her libraries and paid high homage to literature and her learned men.

When Germanicus Cæsar visited Egypt and gazed with wonder on her imposing monuments, he asked the priests to read the inscriptions with which they were covered. They replied: "These record the greatness of our nation in former times, when seven hundred thousand men bore arms and carried our conquests to distant lands," etc. And among the lists of the ancient rulers of those times, they read the name of a queen—Scemiophra. Facts like this speak volumes for the glory of Egyptian civilization, and tell unmistakably how woman was respected and adored in those early days of the world's history. Here were mighty cities, and thousands of canals connecting with the Nile, by which artificial lakes and reservoirs beneath the cities were supplied with water for irrigating the land and supplies in times of drouth. When we read of the long voyages of her mariners, and their cedar ships 500 feet long, we are filled with astonishment.

We cannot trace the growth of the civilization of Egypt; we only know her in her culmination and decline. She bursts forth like a meteor in the first pages of history, or like a bride appareled for her nuptials. While numerous barbaric tribes paid tribute to her power, they seem to have been influenced but little by their contact with the higher life and refining customs of the Egyptians.

So on the plains of Sodom we meet another phase of human development not unlike, in some respects, that presented in the valley of the Nile. Here, too, were numerous cities inhabited by a fixed people engaged in trade and manufactures, of which Sodom seems to have been the most important. When Abraham, the Hebrew (or immigrant, as the word means), fixed his home upon the uplands adjacent to the plain upon which the city stood, he could gaze from the door of his tent upon a scene of rare beauty, where, doubtless, as Croly says,

> "On pomp and spectacle beamed morning's glow,
> On pomp and festival the twilight fell."

It will be remembered that it is in connection with this city that we have the first account of organized warfare. Now the point to be specially noted is this: Among the tribes attacked by the confederated kings who came up against Sodom, was one tribe known as Horites, who also often afterward appear in history. Now these Horites were veritable Troglodytes—cave-dwellers. Here, then, we have the significant fact of a rude and primitive people living near, if not in close proximity, to the sumptuous civilization of the cities of the plain, and still preserving their ancient customs and modes of life. The same thing is taking place before our eyes, in our own country, to-day. The red men are displaced, but are not changed; they resist all our efforts for their civilization.

It will be seen, by the foregoing considerations, with what caution the archæologist should pursue his investigations, and how easily he may be misled in the conclusions he draws from the discovery of rude memorials which evidence almost infantile skill, when found in companionship with relics which indicate a high advancement of the industrial arts and social life; for it has sometimes happened that, under the fascination of a new discovery, able and conscientious men have been led by a temptation hard to resist, to lend the weight of their names to too hasty generalizations.

REV. S. D. PEET, CLINTON, WISCONSIN.

To the same question, Rev. S. D. Peet replies as follows:

CLINTON, WIS., January 10, 1880.

The archæologists have not come to any definite conclusion on the point as to the Stone, Bronze or Iron ages being successive, or synchronous. Many think that they overlapped, and in large districts there is no doubt that the ages did overlap, though it is probable that in localities the stages of society, or the succession of immigrating races, are marked by these distinctions. There is no gap between the Iron age and the pre-historic Egyptians. In fact, it is difficult in ancient his-

toric countries to tell when the Iron began and when the Bronze prevailed, and so, too, when the Bronze began and the Stone prevailed.

As to the *pre-historic* Egyptians, or Chaldeans, no one, to my knowledge, claims that there was a pre-historic age with these nations which can be traced separately from the historic, though in India this is the case, and probably may be in Persia. Troy, you know, had its various ages, as did Judea; but the Stone and Bronze are wonderfully mixed up.

I think Quatrefages is right as to Europe. The singular fact about America is that the highest state and order of man, so far as discovered, is the earliest. The auriferous gravels only confirm my position on that point, and the "missing link" is all bosh. *Tertiary man* may be the missing link, but produce him before you tell what he is.

PROF. O. T. MASON, COLUMBIAN COLLEGE.

And Prof. O. T. Mason answers it thus:

COLUMBIAN COLLEGE, D. C., January 14, 1880.

The opinions of archæologists are so divided as to the continuity of man in any portion of Europe, that it is best to hold our own in abeyance for more light. The craniologists rely upon certain characteristics to determine the question of race, and wherever these marks are found the race is forthcoming. If this be true—if the crania were all found in the exact geological environment from which they profess to have come, if the stratigraphical relations of quaternary beds are accurately known, and if certain cranial marks are the sure indications of certain races—then we may say something about the sequence of pre-historic tribes on a given area.

RECENT ARCHÆOLOGICAL DISCOVERIES IN ADAMS COUNTY, OHIO.*

The Ohio Valley, and this immediate section in particular, is rich in remains of that wonderful prehistoric race, the evidences of whose civilization have been perpetuated in those curious pieces of engineering from which we derive the euphonious name "Mound Builders," given them by archæologists. Within the past few days wonderful discoveries have been made in this vicinity, which open up a new chapter in the history of this remarkable race, and throw much light upon their manner of living, their social nature, and their physical character. In different sections of the world, at different periods of its history, there have been found the remains of an enormous fauna and flora, and of a gigantic race of men. So rare and far apart have been these discoveries, however, that we have looked upon historical accounts of them as cleverly constructed pieces of fiction, and been loth to believe that there ever existed a race of men able to battle with the savage mastodon or the fierce megatherium. It remains for Adams County to come for-

* The statements in this article are very remarkable, but they are vouched for by a friend in whom we have great confidence.—ED.

ward with a startling confirmation of the scriptural text, "And there were giants in those days." For in Adams County have been found not only the bones of a gigantic race of men, but their implements of warfare and husbandry, and excellently preserved specimens of their art in sculpture, painting, engraving and writing.

Whether these prehistoric giants had a hand in the erection of those splendidly designed and durably constructed pieces of engineering which stretch across the country, from the headwaters of the Ohio to the mouth of Rio Grande, there to commingle with a similar chain of roads, mounds and fortifications coming down the Pacific Slope, and continue on through Mexico, Central America and the South American States, to be finally lost in the unexplored barrens of Patagonia, will be left for the solution of a wiser head than your correspondent possesses. He simply relates the facts; the scientists may build thereon the theories.

In conversation with some of the oldest citizens of this county I have been unable to learn the date of the discovery of a cave on the old Smith farm in Tiffin Township. Its existence was known to the earliest settlers, and they probably learned it from the Indians. For years it has been a place of resort for the curious, and was always esteemed a great natural curiosity. The old Smith farm is on the Portsmouth pike, between fifteen and sixteen miles northeast of Manchester. The farm is now owned by Mr. Samuel Grooms, and is a fertile, well-cultivated body of land. About a mile from the pike is a level plateau of two hundred odd acres, surrounded on all sides by lofty hills. As you near the mouth of the cave there is a gradual depression of the ground on all sides, forming what, in the local nomenclature, is denominated a "sink-hole." At the bottom of this circular basin is a hole, three feet in diameter, and about twenty-five feet in depth, at which distance from the surface you strike the floor of the first chamber in the cave, a dry cavern thirty by twenty feet, with smooth floor, roof, and walls of freestone. Crossing the room you enter a corridor five feet wide, connecting it with another chamber, smaller than the first, and this in turn is connected with a third chamber by a similar corridor. The third room is about the size of the first, but it has a lofty, arched dome, and the walls, floor and roof are of limestone. Through this rock water has oozed for countless ages, and formed thousands of glistening stalactites and stalagmites. Nowhere else in the cave do you find the limestone cropping out, and nowhere else do you find these slow-growing formations To gain access to the fourth chamber it is necessary to climb a steep bank and squeeze through a narrow fissure in the rock. In one corner of this chamber is an elevation, which, when surmounted, discloses a yawning well, with a mouth ten feet in diameter, and of unknown depth. Apply your ear to the edge of the well and you can hear the hollow roaring of a stream of water hundreds of feet below. Beyond this chamber are five others connected by narrow galleries. The cave comes to an end against a perpendicular wall of solid rock, in the ninth chamber, and about five hundred yards from the mouth. The floors of all the chambers except the one where limestone crops out, are dry. All are mathematically regular

in shape except this one. They are of different lengths, but all are of the same width and height. It is a romantic place for a picnic, and has been given up to such rural festivities for years. Every corner of the cave has been thoroughly explored a thousand times, and the walls of the limestone chamber are covered with the names of visitors and the dates of their visits. One, high up on the wall, reads, "Von Brady, 1789." Von Brady was a pioneer Indian fighter and hunter, who came here in advance of the "Ohio Company," in 1786. He was a daring man, and sent many of the red men to the "happy hunting grounds."

A few days ago a party of gentlemen visited the cave, provided with a plentiful supply of lanters, ropes and tools, for the purpose of exploring the mysterious well. The following were the gentlemen composing the party: Messrs. M. R. Brittingham and Andrew Long, leading Manchester merchants; Mr. Ernst T. Kirker, one of the editors of the Manchester *Independent;* S. Newton Griffith, Esq., of the Adams County bar; Mr. Samuel Grooms, the owner of the cave, and the *Commercial* correspondent.

Arrived at the cave, it was thoroughly explored, and then a rope ladder, 100 feet long, with which we had provided ourselves before starting out, was lowered down the well, and Mr. Kirker headed the exploration. When about fifty feet from the top of the well he called out to the party above to come down. We hastily descended, to find our friend standing at the entrance of a narrow gallery, leading out from the well. This gallery led back a considerable distance and got wider, debouching finally into spacious chamber.

The distance from the mouth of the well to the top of this gallery is forty-seven feet. From the roof of the gallery to the floor is ten feet, six inches. At its mouth it measures five feet, four inches in width. The gallery is straight, fifty feet long, has a gradual descent, and where it enters the main chamber, twenty-five feet in width. The chamber is 225 feet long, 110 feet wide, and twenty-four feet high. The roof, floor and walls of both the gallery and chamber are smoothly finished. In the center of this chamber is a sarcophagus and mausoleum combined. The mausoleum measures at its base fifty-five by thirty-five feet. It is of simple though wonderful design, and carved out of solid rock. Its base is paneled on all sides, those panels containing bas-reliefs which are supposed to illustrate the four seasons of man's life—childhood, youth, manhood and old age. At the ends of the bas-reliefs are tablets full of written characters, resembling the Hebraic, presumed to be memorials of the person or persons in whose honor the mausoleum is erected. The carving on the bas-reliefs is of the most delicate description, and fully equal to the Grecian school of sculpture. The limits of a newspaper article will not suffice to fitly describe them. From the floor to the top of this base is six feet. The base is hollowed out at the four corners, and these excavations are covered with slabs of freestone, accurately fitted and so firmly cemented that a cold-chisel struck with a heavy hammer made little or no impression on the cement. They are of uniform size, measuring five by twelve feet. In the center of the mausoleum rises a couch, two feet, five inches in height, twelve feet in length,

and five feet in width. On the couch is extended the figure of a man. It is probably of life size, and measures nine feet, four inches in length. The limbs are finely proportioned and disposed in an easy and graceful manner. The arms are folded across the breast, and the fingers clasp a bunch of leaves resembling the oak, reproduced with such fidelity to nature that they look like petrifications. Every vein and serration of the leaf is perfect. The figure is partially nude, a mantle or scarf crossing the breast and falling over the loins in graceful folds. The face is strong and robust in outline, and the contour of the features is decidedly Israelitish. The head is covered with a winged cap or helmet. At each corner of the couch is a vase four feet, five inches high, covered with beautifully carved flowers and leaves. They are in shape something like an amphora, except that the bottom is flat and the handles affixed to the body of the vase. The neck is thirteen inches in length and tapers gradually and gracefully. The vases are of uniform size, although the carved designs are different. They measure in circumference four feet, five inches. Suspended from the roof by delicate copper rods, directly over the head of the recumbent figure, is a copper lamp of unique design, elegantly chased. At each corner of the mausoleum rises a carved pyramid column, surmounted by caps that are unmistakably Doric.

On two sides of the room are tombs of humbler design. They are side by side, of uniform size, and twenty in number; ten on a side. Like the mausoleum, they are carved out of the solid rock, and embellished with bas-reliefs. Their dimensions are as follows: Length, twelve feet; width, five feet; height, five feet. The tops are covered with slabs, securely cemented. On the front of each is a raised scroll, covered with written characters similar to those on the panels of the mausoleum.

On the wall of the room opposite the entrance, are painted twenty-five faces, no doubt portraits of those whose bones lie in the tombs. They are faded and blurred, but still distinct enough to be deciphered. The colors used are red, yellow, black and white, and were evidently laid on with oil. The portraits are executed in a superior manner, and the anatomical portion of the features is preserved to an exact degree.

After our first astonishment over these wonderful discoveries had in a measure subsided, we seized the tools, and set to work to open one of the tombs. It was no easy task. Our chisels would not cut the cement which held the slab in place, and we were at last forced to batter the tomb to pieces. The walls were thin, and a few blows of a heavy sledge-hammer shattered the freestone to atoms. To our great surprise there lay before us not a few handfuls of crumbling dust, but a splendidly preserved mummy, swathed in cloth covered with a thick varnish, which emitted a pleasant aromatic odor not unlike balsam of fir. The mummy measured nine feet one inch in length, and the cloth in which it was wrapped, although of coarse texture, was skillfully woven. One of the party cut the wrappings from the face, but did it so clumsily that the head crumbled into dust. Portions of the hair remained sticking to the cloth, and your correspondent brought some of it away with him. It is black, curly, and of fine texture.

Besides the body of the giant, the tomb contained a spear-head, a hatchet, two lances, three mattocks or hoes, a spade, a cup, two plates and a small urn, all of copper. I appropriated one of the lances and the cup as souvenirs. These wonderful people understood the secret of hardening copper, for an ordinary file will barely scratch the lance, and the edge of a cold-chisel turns up like lead when struck against it. The cup is of softer metal, and beautifully engraved with trailing vines and wreaths. A square package at the head of the tomb, wrapped in the varnished cloth, was opened and found to contain a book of one hundred leaves of thin copper, fastened loosely at the top, and crowded with finely engraved characters, similar to those already described.

Lack of time and the total inefficiency of our tools prevented us from making further investigations, but when we ascended the well, we could plainly discern works of the sharp cutting tools used in excavating the cave. In the first two chambers, and in the last five, we had noticed many curious blocks of stone shaped like tables or benches, and presumed them to be of natural origin Later examination revealed the marks of chisel and pick, and these agents were undoubtedly used to fashion the entire cavern. The irregularity of the limestone chamber is due to natural causes. In all probability the room was dry when the wonderful people who designed and built it were alive. The stalactites and stalagmites have formed since. I measured one of the largest of the former. It was five feet, six and one-half inches from base to apex. Allowing that it lengthened at the rate of one inch every fifty years, which a geological friend tells me is a very rapid growth, it would have been 3,325 years reaching its present length. Conjecture alone can fix the date of the last occupancy of the cave. It must have been years before the stalactites began to form. I examined the mouth of the cave and discovered traces of a stairway which once led to the surface of the ground. Indeed, I found broken fragments of rock which, five or six thousand years ago, were undoubtedly parts of a broad staircase. There were also traces of a stairway which once wound around the sides of the well, affording easy entrance to the lower cavern. The upper cave must have been the cellar of a residence built above ground, and used for domestic purposes or a place of retreat in time of danger.

Mr. Grooms intends to open up all the tombs and the great mausoleum, arrange convenient means of entrance to the cave, and throw it open to the general public, charging a small price of admission to reimburse him. Several parties have visited it since the discovery of the lower cavern, and all are impressed with the wonderful character of the discoveries. Mr. Grooms is anxious to have a scientist examine the cave, and at his request a description of the discoveries, together with the engraved book, have been forwarded to the Smithsonian Institute.—***Cincinnati Commercial.***

MASONIC DISCOVERIES.

Dr. Fanton, a highly instructed Mason, has finished a very careful examination of the foundations of the obelisk known as Cleopatra's Needle, at Alexandria, Egypt, and confirms Lieutenant-Commander Gorringe's discovery of the Masonic emblems, which establish the relations of many ancient Egyptian monuments. Dr. Fanton declares that the Hiram version of Masonry originating with the construction of Solomon's Temple, is disproved by the revelations of the foundations of the obelisk.

The Masonic emblem of Life and the Sun beyond doubt is identical with the Egyptian god Osiris. This proves that Masonry originated with the construction of the Pyramids, or at least with a far remoter period than the construction of the foundation of the obelisk. The number of blocks comprising the foundation, as well as their position and arrangement, indicate that the ancients were familiar with the higher degrees of Masonry—at least as high as the eighteenth degree. Many peculiar emblems, not understood by Lieutenant-Commander Gorringe, were fully explained by Dr. Fanton, from a Masonic point of view.

This discovery furnishes a clue to other important discoveries, not only under the fallen obelisks, but also in other parts of Egypt, rendering probable a solution of the mystery of the construction of the Pyramids. Among the discoveries was found a perfect cube, and also emblems of all Masonic foundations.

Lieutenant-Commander Gorringe, who is a member of the Masonic fraternity, entirely approves Dr. Fanton's explanation.

GEOGRAPHY.

ANCIENT GEOGRAPHY.

CAPT. E. L. BERTHOUD, GOLDEN, COLORADO.

(*Continued.*)

If we examine any modern map of the world, say one of Justus Perthes' last publications, in which the most recent discoveries are embodied, we will observe that, although in the South Pacific Ocean DeBougainville, Kerguelen, Marion, D'Urville, Cook, Wilkes and others have sailed in various and devious courses in the Antarctic seas, yet vast tracts of that ocean have never been visited by man, and that we have an ideal Antarctic Continent set before us that has been dimly seen—and never explored—at a few points, distant from each other, and of whose extent and proportions fogs, snows and a sea covered with floating ice rendered uncertainty more uncertain. It is yet a real *Terra Australis Incognita.*

Patavino is here, however, quite positive from his standpoint, and in no manner sparing of theoretical information on this unknown Southern Continent. Just where he obtained his information about this circumpolar continent south of the Spice Islands and Java, we cannot now so clearly tell; but it proves that already, in 1597, Autralia was definitely known. Yet ninety years afterward, when Dampier explored the west and north coasts of New Holland, and also New Guinea, Australia was known only to him as Eëndracht's, or Houtman's (Dutch navigators who were popularly supposed to have been the first to ever sight its shores) Land.

The Spanish explorer and navigator, Quiros, who had traversed, in about the years 1605 and 1606, the whole South Pacific from South America to New Guinea, proclaimed his discovery of lands in the South Pacific, christening them "Terra Australis." In after times his discoveries for a long period puzzled other navigators, who in vain ransacked the South Pacific Ocean for his continent, lost to all others, and which Capt. James Cook proved did not exist except as an ice-clad Antarctic land, formed, perhaps, only of islands that are connected by the enormous ice-fields of perpetual frost—fit habitation for the penguin and the ever-restless albatross.

From the Terra Australis, if we follow Patavino's map into the China seas, we will find here but few of our modern familiar names. But even when we find the Moluccas, Philippine Islands, Mindanao, Matelotes, and Japan, how unlike in shape and erroneous in position! Looking at the Chinese coast, we see a general resemblance to modern maps, but we find no Corea, no Saghalin Island, no Kamtschatka, even after we pass the last two points where we would expect to see them. Instead of this, we have a coast bearing off to the north from the parallel of 40° north latitude until we reach the 59th parallel of north latitude. Here we find delineated Cape Tabin, the most northeasterly point of Asia washed by the Arctic Sea, which is shown as stretching eastward more than 25° of longitude to the American coast, which seems to bear in direction east-northeast, very much as it is known to-day, between Behring's Strait and Icy Cape.

But here we find the queerest bit of information possible. Our modern geographer gives us, as his authority for the location of Cape Tabin, Pliny himself! For, in Book VI, Pliny says:

"Beyond the Caspian Sea and the Scythian Ocean, the land projects far to the east, * * * the face of its shores being turned toward the rising sun. Next to this the land is uninhabited, from the amount of snow. The next region is wholly uncultivated, from the ferocity of its inhabitants and the multitude of wild animals. Beyond these deserts are other Scythians; then other solitudes, as far as the ridge of mountains overhanging the sea which is called Tabin."

Pliny does not give his authority for these statements; but, evidently, he had them from some one who, in the zenith of Roman power in Asia, had penetrated into the Siberian deserts. But this was enough for Patavino. So he gives us a very creditable map of Siberia, with the peninsula of Cape Taimur, which he calls Scythicum Promontorium, extending to about 82° north latitude. In this land of

desolation, Siberia, he gives us a lake and a river, which in Taimur Land are known to-day as Taimur Lake and Chatanga River, where he also locates the places of habitation of several Siberian hordes. Eastward of Taimur we see a large river beyond what he calls Chiorsa, or the Karakorum Desert. This river begins in the Altai Mountains, and probably was meant for the River Lena, but its mouth is located in about latitude 56°, while southward, but up the river, appear the cities of Cambalu, Tenduch and Xinguer, so much celebrated by Marco Polo. But, as their location is given north of the Altai Mountains, and as these cities were Mongolian, or Chinese, this, with the erroneous latitudes given, makes it plain that our mediæval geographer was much mixed in his authorities. This is still more evident as the Karakorum pass and desert lie immediately north of the vast Himalaya Mountains, and is one of the avenues into central Tartary.

Among the various facts (?) that we find given by our author in his description of Tartary beyond the Jmaus (Himalaya) Mountains, which he calls Cathay. Tangut, Tendu, Tebet, Koondo, etc., as its several provinces or kingdoms are called which are under the empire of the Grand Cham of Tartary, whom he describes as a descendant of the great Ghengis Khan. Then he naively tells us that "it is quite evident that his (the Great Cham's) money is not made of any metal, but is made of mulberry bark, reduced to pulp and held together by some glutinous substance, upon which, indeed, is *printed* the royal seal; so that, by means of this manufactured money (*factitia moneta*), he has accumulated an enormous amount of gold, silver and precious stones." A regular Greenbacker was the Grand Cham, who has many to-day that are emulous of his questionable money fallacies.

We will now leave our old worthy professor and his many whimsical conceits, and give him the credit for showing us that even at that time the fact was known that Asia and America were separated by a strait, and its discovery can not be claimed by the Russians as an original discovery by Behring, but that, long before him, one Staduclein, a Russian traveler, had sailed from the Lena and Judighirka, around the Schelagakoi Noss, or North Cape, and had reached Behring's Straits, just as, in 1879, Professor Nordenskjöld has demonstrated can be done by his wonderful trip from Cape North, in Norway, to Behring's Straits—all the way around Taimur Land, New Siberia, Baranow Island and North Cape to Behring's Straits and Japan. By him the mysteries of the "Scythicum Promontorium" and Cape Tabin are solved.

EXPEDITIONS TO THE ARCTIC SEAS.

CONGRESSIONAL REPORT.

[In the House of Representatives at Washington, on January 15, 1880, Mr. Whitthorne, from the Committee on Naval Affairs, submitted a report from which the following extracts are made:]

The Committee on Naval Affairs, to whom was referred House Bill No. 1823, "to authorize and equip an expedition the Arctic Seas," having had the same under consideration, have directed the same to be reported back to the House with a substitute therefor, and thereupon to recommend the adoption and passage of said substitute, herewith submitted:

In making this report the committee respectfully state and report that the object of the bill, as is shown by its terms, is to authorize a temporary station to be selected within the Arctic Circle, for the purpose of making scientific discoveries, explorations, and observations, obtaining all possible facts and knowledge in relation to the magnetic currents of the earth, the influence of ice-floes therefrom upon the winds and seasons and upon the currents of the ocean, as well as other matters incidental thereto, developing and discovering at the same time other and new whale-fisheries, now so material in many respects to this country. It is, again, the object of this bill that this expedition, having such scientific observations in view, shall be regularly made for a series of years, under such restrictions of military discipline as will insure regularity and accuracy, and give the fullest possible return for the necessary expenditure; and, again, in view of the fact that either the governments directly, or scientific corps under their authority, of Germany, Holland, Norway, Sweden, Austria, Denmark, and Russia, have concurrently agreed to establish similar stations, with like object, during the year 1880, it is believed that the interests and policy of our people concur in demanding that the United States should co-operate in the grand efforts to be thus made in the solution of the mysteries and secrets of the North Polar Seas, upon which, in the opinion of scientists, depends so much that affects the health and wealth of the human race.

This subject has for many years, and especially during this century, engrossed a very large share of the attention of the scientific world. The enthusiasm of those who have ventured so much, in a region where naught of individual profit could be an inducement, and the sole motive could only be "the good of mankind," is worthy of our highest regard and admiration.

Congress has, at different times and in different ways, given the sanction and encouragement of the Government of the United States to expeditions and explorations into this region, and always, as your committee believe, with the approbation of the people, and lately, with singular unanimity, to the expedition fitted out by a distinguished, wealthy and liberal citizen of the United States, Mr. Bennett, whose vessel, the Jeannette, now under command of Commander De

Long, of the United States Navy, sailing under the national flag, by authority of Congress, is penetrating this ice-bound region by way of Behring's Straits; and no well-informed citizen but hopes with pride that success shall mark the venture, and that, in its beneficent results to science and humanity, the generous liberality of the owner of the Jeannette shall find his deserved reward.

Your committee, aware of the deep interest felt in these explorations, and particularly that which has been manifested in the plan known to the American public as the "Howgate plan," as is manifest in the petitions and memorials from scientific and commercial bodies of all parts of the country, sent to this and preceding congresses, and desiring that its friends should briefly explain its history, purposes, and expected resesults, by addressing them the following queries, to elicit this information and so present it to the House, and which they here now present.

On behalf of the committee, it was requested that it should be shown—

I. Chronologically, a brief of the various national expeditions to the Polar Seas, and under what auspices made.

II. A brief of the alleged scientific results of these expeditions, and references.

III. What are the expected and hoped-for results from the proposed expedition, scientific and economic?

IV. The special reasons, etc., for the plan proposed by the bill H. R. No. 1823.

To which answer was made as follows:

I.—CHRONOLOGICAL.

Two expeditions were sent out by the Russian government in 1820, commanded by Admiral von Wrangell and Lieutenant Anjou, to explore the regions north of Siberia.

The following expeditions were sent out by the British government in the years named:

Captains Ross and Parry, in 1818, to discover the northwest passage, and Captain Buchan and Lieutenant (afterward Sir John) Franklin, in the same year, with a thoroughly equipped expedition, to reach the Pole.

Captain Parry, in 1819, was sent to explore the regions north of Hudson's Bay.

Sir John Franklin was sent out on a land expedition in 1820 to explore the north coast of America.

Captain Parry was sent in 1821 to explore the regions north of and around Hudson's Bay.

Captain Parry was sent again in 1823.

Captain Lyon was sent out in 1824, via Hudson Straits.

Sir John Franklin made a second land expedition in 1824, *via* the Mackenzie River.

Captain Beechey was sent in 1825, *via* Cape Horn and Behring's Straits.

Captain Parry was sent in 1827 to reach the Pole, via Spitzbergen.

Lieutenant Back, in 1833, was sent in command of an overland expedition through the Hudson Bay territory.

Captain Back was sent in 1836 to complete the survey of portions of the coast-line north of Hudson's Bay.

Sir John Franklin was sent out in 1845 to search for the northwest passage.

In 1847 the British government sent out three expeditions to search for Sir John Franklin.

In 1850 three other search expeditions were sent out by the British government.

In 1852 Sir Edward Belcher was sent out in command of five vessels to search for Sir John Franklin.

In 1852 Captain Inglefield was sent out to search for Sir John Franklin.

In 1875 Captains Nares and Stephenson were sent out to reach the Pole, *via* Smith's Sound. This was one of the best equipped expeditions of modern times.

In 1869 the German government sent out an expedition in command of Captains Koldewey and Hegemann, toward the North Pole.

Austria sent out an expedition in 1872, in command of Lieutenants Weyprecht and Payer, to reach the Pole via Nova Zembla.

The United States sent out Captain Hall, in the Polaris, *via* Smith's Sound, in 1871.

These comprise the principal governmental Arctic expeditions during the present century. During the same period a large number of private expeditions have been fitted out in this and most of the northern countries of Europe. The expeditions of De Haven, Kane, Hayes, and Hall, from the United States, and those of Professor Nordenskjöld, from Sweden, received some slight aid from their governments, but their cost has been borne principally by private citizens.

For detailed accounts, see the published narratives of the several expeditions. For a brief account of the work done before 1857, see a small work by Epes Sargent, called "Arctic Adventures." See, also, for this, the preliminary chapters of the "Narrative of the Second Arctic Expedition made by C. F. Hall, 1864–69," prepared by Professor Nourse, United States Navy, under orders of the Secretary of the Navy.

II.—SOME GEOGRAPHICAL AND SCIENTIFIC RESULTS OF PAST ARCTIC VOYAGES.

1. The discovery and survey of the vast territory lying north of the American continent, between the sixtieth and eighty-third degrees of north latitude, and longitude 50° to 170° west of Greenwich.

2. The discovery of Francis Joseph Land and Wrangell's Land, north of Europe and Asia, and of the survey of the northern coast-lines of these continents.

3. The discovery of the magnetic pole, which has proved so valuable to commerce and navigation.

4. The discovery of new whaling grounds, notably by Captain Hall, in Cumberland Gulf and adjacent waters, by which millions of dollars were added to commerce of the United States.

5. New species of birds, of animals, and of fishes have been discovored, some of them of commercial as well as scientific value.

6. New minerals of value have been found, some of which do not exist elsewhere.

7. Interesting studies in ethnography and kindred sciences have been made.

8. Our knowledge of magnetism, electricity, meteorology, and of ocean currents has been greatly increased by observations within the Arctic regions.

See, also, the narrative of Professor Nourse, before alluded to.

EXPECTED AND HOPED-FOR RESULTS—SCIENTIFIC AND ECONOMIC.

The plan proposes to take only such persons already in the public service for whose pay and subsistence the government now provides; the vessel is no charge, and only such small sum as may be necessary to prepare it for this special service is sought from the government.

While your committee believe that the interests of geographical and scientific discoveries as set forth by Professors Henry, Loomis, and others, in connection with the proposed Arctic station, are of themselves of sufficient magnitude to warrant favorable legislation, they do not exclude the additional practical consideration of the political and commercial results that are probably to flow from the discovery of new fields for the whale-fisheries. That large section of country from which springs the American sailor, whose education and wealth is largely derived from these fields, is entitled, as a matter of justice, to have their interest cared for in this direction. This home of sailors becomes, not only an element of commercial wealth, but a resource of national defense, which should not be lost sight of by the American statesmen. It is for these considerations your committee have been induced to report favorably upon the plan proposed in H. R. No. 1823.

[Substitute foi H. R. No. 1823.]

A BILL TO AUTHORIZE AND EQUIP AN EXPEDITION TO THE ARCTIC SEAS.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

That the President of the United States be, and he hereby is, authorized to establish a temporary station at some point north of the eighty-first degree of north latitude, on or near the shore of Lady Franklin Bay, for purposes of scientific observation and exploration, and to develop or discover new whaling-grounds; to detail such officers or other persons of the public service to take part in the same as may be necessary, and who are willing to enlist for such purpose, not exceeding fifty in number, and to use any public vessel or vessels that may be suitable for the purpose of transporting the members of said station and their necessary sup-

plies, and for such other duty in connection with said station as may be required from time to time: *Provided*, That the President of the United States is authorized to accept from H. W. Howgate, and fit out for the purposes of this expedition, the steamship Gulnare, which vessel shall be returned to its owner when the objects of the expedition shall have been accomplished, or when, in the opinion of the President, its services are no longer required: *Provided further*, That the United States shall not be liable to any claim for compensation in case of loss, damage, or deterioration of said vessel from any cause, or in any manner whatever, nor be liable to any demand for the use or risk of said vessel.

DEATH OF AN AFRICAN EXPLORER.

Intelligence has been received at Paris that the Abbė Debaize, in attempting to cross Africa, has died at Ujiji. He was commissioned by the French government to traverse the continent from Zanzibar to the Atlantic, and to aid him the sum of $20,000 was appropriated. He left Marseilles on April 21, 1878, and organized his expedition, with nine missionaries and 400 camp followers, in less than two months. On July 25, he left the coast and after passing a Belgian missionary expedition, he made his entrance with flags flying and music playing into Kouihouron, the capital of Unyanyembe. Thousands of negroes gathered round and received the travelers with boisterous and uncouth welcome. The Sultan and Governor came out to the city entrance and conducted them to the building that Cameron had occupied before them. In his report to the Minister of Public Instruction the Abbé stated under the date of October 17, that hitherto his mission had been lucky and that not one of the hundred men in his caravan had deserted. The Abbé had been in good health all along and had managed to preserve his baggage intact.

PASSAGE OF THE "MIDDLE PACK."

The southern edge of the "North Water" extends from Pond's Bay on the west side in a northwesterly direction to Cape York, and there are three routes through the middle pack by which it may be reached. The first and only safe one is called by the sailors the "North-about Passage," along the Greenland coast. The second is by entering the drifting pack in the center of the Bay. It is called the "Middle Passage," and should only be attempted late in the season, when the land ice of Melville Bay is generally broken up. The third, called the "Southern Passage," is along the west side of Baffin's Bay, and can only be effected late in the season, or after a long continuance of southerly winds.

The earliest passage into the "North Water" was made on June 12, 1849, and the average date of passage made by whalers for twenty-three years was July 13th. In the years 1825–28–32–33 and '34 the whole whaling fleet got through to the "North Water" before the middle of June. John Davis was stopped by

the ice of the "Middle Pack" on July 1, 1587. Baffin reached the "North Water" in 1616. Ross and Parry reached it August 8, 1818, having been thirty-eight days getting through the pack. In 1853, Dr. Kane, in the Advance, reached the "North Water" August 3d, after a passage of eight days. In 1860, Dr. Hayes in the United States, (a sailing vessel,) made the passage in fifty-five hours. In 1871, Capt. Hall in the Polaris, made the passage in less than twenty-four hours. In 1875, the Alert and Discovery, of the British Expedition, left Upernariv on the evening of July 22d, and sighted Cape York on the morning of July 25th. The passage through the pack was made in thirty-four hours.

The navigable season continues until the end of August, but the edge of the pack should be reached by the middle of June if practicable.

TECHNOLOGY.

THE RELATION OF ÆSTHETICS TO INDUSTRY. *

V. W. CODDINGTON.

There is established in man an earnest desire for the excellent. It is one of the characteristics of the human being to choose the superior in preference to the inferior. The exercise of the faculty of choice is the chief occupation of mankind. The earliest intelligence displayed by the infant, is when it can distingush one object from another and make choice between them. And the highest functions of intellect exercised by the sage are of the same order, when he considers the delicate distinctions that separate one theory from another, and gives one peference over another.

The question of approval and disapproval comes before every human being at every step of his existence—man travels through the world smiling at this and frowning at that. The sky is brilliant with the hues of sunset. He is pleased. He looks abroad upon the green fields with their trees and flowers, and birds and brooks, and says, "It is good." But the rain and snow, the frost and wind; these are elements of experience that are not so agreeable. They seriously deange his pleasures; they disturb his enjoyment of these many beautiful things; they even interfere with the ready obtainment of the necessaries of life. Consequently the desire to better himself, and multiply around him comforts and excellencies.

This desire for excellence has been from the first, the germ of human growth; the mainspring of all progress, the paramount motive impelling men to action. It is the guiding spirit of intellectual advancement. It is the abiding inspiration of the artist. In the commoner matters of life it originates every invention; is the father of improvement. In short, whatever that is commendable, whatever of good

* Read before the Kansas City Academy of Science, January 27th, 1880.

or worth that has been accomplished by men, is due to their desire for the excellent. Now we propose to consider this question, at present, where its phenomena have taken shape in the industrial arts. Every industry finds its reasons to exist in this desire for something better.

The primitive man, to facilitate the labor of his hands discovered and manufactured the stone ax. His descendant, not yet satisfied with the efficiency of the tool, improved it by using copper instead of stone, and generations still farther along in the course of time, had recourse to iron, and of later in years the finer and more excellent form of steel.

Though long centuries measure off the distance between the rude beginning and the perfect consummation, and the advancement made was so slow as to be almost imperceptible, each step taken was the out-growth of that insatiate craving for the excellent.

Now the elements of excellence are as manifold as the objects which possess them. Some are obvious; they force themselves upon the understanding; they can not be contradicted. Others are not so palpable, it requires an effort of the reason to bring them to the surface, and they become well defined only after diligent inspection. Again, there are others which are as subtile and delicate as sweet perfume, one recognizes and appreciates and approves them, but can give no reason why. For the sake of convenience we will divide all of the elements of excellence into two classes. 1st, the obtrusive. 2d, the abstruse. I can best define the distinction between these two classes by illustration.

The savage enhances the value of his arrow as a destructive projectile, by pointing it with some hard substance, such as flint or iron. He increases its accuracy by fastening feathers to the end. To keep his arrows together and have them ready for immediate action he makes a quiver. These things possess the obtrusive elements of excellence. They have an obvious reason for existing. No one will question but that they have a purpose and are adapted to that purpose. But the rude man is not yet satisfied. There is in his nature that which calls for something more. He stains the feathers of his arrow. He stripes his quiver with various colors and begirts it round about with a fringe. In his own estimation he has added greatly to their value. What he has added constitute some of the abstruse elements of excellence.

Again, for I would have this distinction clearly understood: The Fiji Islander for the purpose of propelling his canoe, manufactures a paddle. With the greatest care he measures the length of the blade and its width, and the length of the handle. He pays great attention to shaping it in such manner as to obtain the maximum amount of efficiency with a minimum amount of exertion. The implement possesses all of the obtrusive elements of excellence. As a paddle it is complete; but the Fiji goes farther, with much care and skill he cuts the entire surface of the paddle into various delicate patterns. It now possesses abstruse elements of excellence, and they add to its value three, four, or even ten-fold; while as an object of utility he has not at all increased its worth. But he has an

article, which, in the markets of Fiji-land will command a much higher price than if left as he first made it. The first act of this savage in the making of his paddle was the work of a mechanic, the second part of the work was that of an artist, each we will say, was perfect in its conception and in its execution, and the result is an implement perfectly adapted to its purpose and a never ending source of pleasure to the beholder. Thus the Fiji Islander attempts to manufacture all of his utensils, be they instruments of war, of the chase, or for domestic purposes. All of the savage tribes, to a greater or less degree are actuated by the same motives, and they are typical of those early workers of the Orient, who gave the first impulse to industrial art

EVERY complete product of industrial art is the joint effort of the mechanic and the artist. The mechanic having as an object, the obtrusive, and the artist working in the interest of the abstruse elements of excellence. To determine the relative importance of the labor performed by these two individuals is a problem not easy to solve. It is much akin to the solution of the question, which is the most important part of the plant, the flower or the stalk? The value of that which has utility no one will gainsay. We measure our advancement in civilization by the improvements which we make in the process of gaining the necessities and comforts of life. The plow, the steam-engine, the reaper, the spinning-jenny, the sewing machine; these are mile-stones in the progress of civilization. We point at them with pride and say, "These are the proofs of our civilization." These are the things which help satisfy the demands for food and clothing. But if we go abroad in the world, we find that in addition to the hunger for food and clothing, there is a hunger of the intellect, and a hunger of sentiment, both of which make their demands, and their demands are urgent. Take man in the aggregate and the æsthetic part of his nature calls for gratification almost as loudly as his stomach calls for food. I have seen the American Indian exchange pelts representing months of labor in hunting and trapping for a few yards of broadcloth, some calico and some beads wherewith to decorate his person, and his example is followed to greater or less degree by his fellow-beings the world over. The civilized man demands æsthetic qualities in almost everything with which he has to deal. He spends—notably the feminine part of him—many millions yearly, to gratify the love of beauty, and with every article produced in the higher manufacture, the question always arises, "How does it look?" This question forced itself upon the untutored citizen of pre-historic times while fashioning his rude vessels of clay, as the remnants of them unearthed to-day bear witness.

Granted now that both of these attributes, the useful and the æsthetic, the obtrusive and the abstruse elements, are essential to the perfect product of industry, how are we to obtain them in the highest degree of perfection? It is an uncomfortable fact that the product of "civilized" industry is oftentimes wofully ugly, grating harshly against our finer senses or perchance, if forced upon us from childhood, drowning out what little artistic feeling we may naturally possess. On the other hand, I have seen objects for the purpose of beautifying which, so much labor had been spent that they seemed to have risen above their station and al-

most utterly refused to do the work allotted them, and when approached with intentions of honest use, seemed to warn one off with the ejaculation, "Don't, don't touch me. I'll, I'll break."

These are extremes into which we are at all times in danger of running, examples of both besetting us upon every hand. But such a result is not due to a want of harmony between the useful and the æsthetic, between the obtrusive and the abstruse elements of excellence, because they do exist in the same object in the highest degree of development. The great intellect that fashioned all things did not decree that beauty and use should go apart; that the stern, practical processes of our nature should of necessity be unadorned. Nature points to the converse. Those material things which are endowed with the highest functions of usefulness are made the most beautiful; and we, if we reach not such a consummation in the works of our minds and our hands, must blame our own shortsightedness rather than the incompatibility of the thing. The history of art industry shows us many beautiful things which served an humble purpose. For example, the water-pots of the ancient Greeks and Egyptians. Some of them were made for the purpose of storing water in large quantities; they had large receptacles, large bottoms, were open-mouthed, and easy of access. Others were made to accommodate the general purposes of the household, substantial bases but not cumbersome, and the body of the vessel was so arranged with reference to the handle that a slight turn of the wrist was sufficient to pour out the liquid. Other vases served the purpose of carrying water long distances. You all know the old custom, how the maidens gathered at the fountain and at the river to get water for the household. The vessels which they used were made larger near the base, and of such shape as to be easily carried upon the head, the neck of the vessel being very small to prevent the water from splashing easily over the top. Handles were provided of such shape that two persons could easily carry a vase between them, and if placed in the water it would dip under the surface without any exertion upon the part of the owner. These different vases were all admirably adapted to the work which they were to perform, and yet they were so exquisitely shaped that to-day we buy feeble copies of them and place them upon our mantles as ornamental features.

The people who made these vases were artists, artists in the truest sense of the word; studying utility with the closest fidelity, and at the same time touching their work with an inspiration that made a thing of beauty out of the humblest implement. Does any one think that we have progressed in this respect? Does he remember how he tried to get water out of a cistern, with an ordinary wooden or tin pail, how it persistently kept its gaping face above the water, and how he wished for a hundred-pound weight to drop into it? and how, when after much perseverance he had the pail filled, he lost a large percentage of the liquid trying to get it into the house? And who has not seen the good wife grow red in the face, as if in imminent danger of bursting a blood-vessel, while attempting to induce a coffee or tea-pot to part with a portion of its contents? And who among us is ready to put in a plea for the *beauty* of the modern pail and coffee pot?

Now some one will say that it is taking unfair advantage to draw example from so lowly a place as the kitchen. I answer, that the humblest flower has its fragrance, and that the humblest utensil may bear the fragrance of art. There is a false conception, which has prevailed for many hundred years—I am glad to know that it is beginning to decay—that there could be no coalition between high art and practical industry. The truth is, they were wedded long centuries ago, and all discord that has risen between them since has been entirely due to the ignorance and egotism of their respective disciples. Said disciples have admirably succeeded in misunderstanding each other. The artist says to the mechanic, "You are ignorant and boorish; you have no taste. If I couldn't make a better looking thing than that, I would make nothing." The mechanic says to the artist, "I'm a practical man. I don't know anything about your fine-spun theories; but when I make anything it works, and I guess it looks just about as well as any o' your fancy fixins."

The result is discord where there should have been union. The artist, if he deigns to serve the manufactures with his genius, produces ornamentation incompatible with the nature of his work. The mechanic manufactures articles ostensibly to serve a useful purpose. It may be bureaus or bedsteads; but he finds among his customers a very decided demand for something more than mere utility, and he, of course, attempts to satisfy that demand. The result is often—from the artist's standpoint—a conglomeration of monstrosities frightful to behold; but there is the evidence of the attempt, ofttimes a very expensive one, and the public is satisfied and calls it splendid.

From the above, we may set this down as a rule; that if any product of art industry is imperfect, the artist who made it was not a mechanic, or the mechanic who made it was not an artist. In our own country to-day, it would, usually, read: "The mechanic who made it was not an artist." This being true, probably the quickest way to reach the best results in industrial art would be to make an artist out of the mechanic. In Massachusetts, steps have been taken in this direction. Art schools have been established with the express purpose of introducing art into industry, and they are doing a good work. The only fault that we can find is, that there are not enough of them. They ought to be established all over the country. The result in a few years would surprise the most sanguine. Not only would art receive an impulse, but manufactured products would be better in every respect; for, if the mechanic becomes an artist, he is the better mechan c for having become so.

But we cannot expect a great deal of progress in art industry until the people, the general public, are able to distinguish the good from the bad. As long as poor art is marketable, it will be manufactured; and when no distinction is made betwen the inferior and the superior, the inferior will predominate. The Centennial Exhibition did much for the education of our people in this respect. As an instance, see the advancement that has been made in the art of book-binding. What a contrast is presented between the work of to-day and that of a few years ago, both in the beauty and the quality of the work. Other departments of in-

dustry have also received great benefit from the Centennial Exhibition. But we, as a people, have much to learn; we are yet on the threshhold. Our homes as receptacles of art are poverty-stricken. The time when every article we use shall give forth the fragrance of good art feeling is yet to come.

It may not be amiss, in this connection, to consider what are some of the essential requisites of excellence in art industry. You will remember that I divided the elements of excellence into the obtrusive and the abstruse.

Of the obtrusive elements, stands, First, Utility. Nothing has a reason to exist unless it serves a purpose. Nature abhors uselessness as intensely as she abhors that vacuum which we hear so much about. She never, in all of her labors, creates anything that has not a definite work to perform, and when the task is accomplished disintegration commences, and the elements of which the thing is composed are hurried off to the performance of other duties.

Second—Durability. Other things being equal, that article of manufacture which is to all appearance most durable, is accounted most desirable The chair that would endure but one sitting, no matter how pretty it might be otherwise, would have but little art value. And, of two similar chairs, the one that would outlast the greater number of sittings would be the most valuable. The mediæval architects understood this principle. Using, as they did, as little material as possible, their structures always took that pyramidal form which the eye knows to be the form of durability. The old cathedrals standing to-day bear evidence of their wisdom. There is something in the mere capacity to endure that excites our admiration, and especially attractive is it when we find it in the works of men.

These attributes of excellence—utility and durability—are dominant; their claims are above all other claims. They admit of no interference with their rights. Any object of industrial art which does not possesss them is not what it should have been.

There is a false idea of art—notably prevalent during the Renaissance period, which dates from the fifteenth century until now—which places the claims of beauty before those of durability, and ofttimes of utility. Articles of furniture were cut and carved into all manner of grotesque shapes, under the impression that so they were more beautiful, though the nature of the material used cried loudly against it:

(*Continued.*)

It is not surprising that barley, potatoes and many other plants and vegetables ripen in the most northern latitudes, seeing that they are exposed to a considerahle amount of heat during two or three months of the year. In those regions where the sun hardly descends below the horizon in summer, there is no night, only a short twilight; the growing plant, therefore, enjoys permanently, and without interruption, the heat and light which it requires.

ENGINEERING.

SANITARY ENGINEERING IN KANSAS CITY. *

BY ROBERT GILHAM, C. E., KANSAS CITY.

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Kansas City requires very extensive sanitary improvements, and the question of method should have been determined long ago. Instituting works of this character, at the present stage of the city's history, will require larger sums to complete than if they had been organized earlier in the city's growth. It is apparent that time has been wasted.

It is necessary first, to become acquainted and familiar with the local and general requirements of the city. A topographical map of the city should be made, indicating the contour of the surface, including a great portion of the surrounding country, and especially that territory which will soon be incorporated in the city. All the main drains, outlets and laterals, districts and sub-districts should be clearly indicated, including also diameters, areas and inclinations, in a table of references, which should be determined after a careful and extended examination of the maximum and minimum amount of rainfall within the proposed drainage area, and all other means that will directly or indirectly contribute to the volume in the sewers.

The nature of the soil, and inclinations of streets and surface generally should be carefully considered, as they become important factors in the computations. After all the facts have been obtained, the city government should adopt such plans as the engineering skill employed can furnish. There should be a general plan, and all local improvements should be made to conform to it. Modifications may become necessary in the execution of the works, to meet unforeseen circumstances which can be overcome without materially changing the general plan. No modifications should be made to accommodate ward politicians for the sake of political influence. Politics should have no part in the execution of these improvements. It is the experience of other cities that where politics play a part in improvements of this kind they inevitably prove a failure. It is true there is a great cost attached to sanitary improvements, and usually it requires years to complete them, but when fully completed the city possesses a work of the greatest possible utility. In studying the topography of our city we find that the natural summit lies very nearly in a line, the direction of which is as follows: Beginning at Woodland avenue near Eighth street, thence running in a southwesterly direction to Ninth street, following the same, westerly, to Locust, south to Tenth and west to Grand avenue, northwesterly to the corner of Ninth and Walnut, southwesterly to the corner of Twelfth and Main streets, thence northwesterly to

* Read before the Kansas City Academy of Science, January 27th, 1880.

Eleventh and New Delaware streets, thence westerly following the direction of Eleventh to Washington street, southwesterly to the corner of Summit and Lykins, thence in a southwesterly direction following the summit of the bluff.

South and east of this line we find that nature has formed a large basin into which the rainfall from the surrounding hills and country flows, embracing an area of nearly fifteen hundred acres. This area is considerably less than the actual area drained by the natural water courses that stretch out in a great variety of directions in their meanderings through deep ravines and gentle slopes of surrounding hills. North of this line, the greater portion of our rainfall, or storm-water, seeks the Missouri River; that is to say, the general inclination of surface is toward that stream. South of it the storm-water seeks the lower levels of this natural basin. The question naturally presents itself, "How can this basin, covering so large an area in our city, be relieved of its waste and natural drainage? Two methods have suggested themselves to my mind, and I have also heard a third method discussed by not a few of our representative men, which has not to my knowledge received a great degree of encouragement. Of this I speak first.

The plan referred to suggests the conversion of O. K. and Turkey creeks into an outlet or main sewer, discharging its accumulations of filth into the Kansas River at its present junction with Turkey creek. There can be no question as to the apparent lack of merit in this plan, which has not the slightest indication of permanent utility, and I question whether the advantages gained would, under any circumstances, balance the evils generated by its execution, or recommend it to any thoughtful and cautious engineer or intelligent citizen.

It is true that such an outlet would convey away the waste from the houses within the area referred to, but it would discharge its accumulations in a place and condition that would occasion full as great evils as if the waste had been permitted to remain scattered throughout this area. At the place of discharge it will be in a concentrated form, and therefore more dangerous. West Kansas, Armstrong, Riverview, Wyandott and not a small portion of the city proper, would be subject to the evils arising from its decomposition and putrefaction. Kansas River has a very low velocity. There are also jetties extending into the current of the river, large pockets have been formed by the continual falling in of its banks. Behind these jetties and in those pockets sewage will accumulate. We also find another objection in the apparent backing of the water at its confluence with the Missouri River. It meets directly the full force of its current which is certainly a very peculiar feature. This method would occasion the passage of the sewage entirely around the city.

We cannot estimate the evils that will necessarily arise and become constant during its passage. To my mind, by the execution of this plan a permanent evil will be established, and the rate of mortality materially increased. In place of this method I would suggest the building of a main outlet sewer, making the capacity of discharge equal to a circular sewer twelve feet in diameter, beginning south of Twentieth street, near Main, and following the general direction of O. K. creek, straightening it, however, in many places, to a point near the junction of

Turkey creek, thence curving to the right or northwesterly, to the east side of the last mentioned stream, straightening it, also, in several places, and thence along the easterly side of the same to the water-works. At this point I would suggest the construction of a large flushing gate, so, if at any time it became necessary to flush the sewer between the Missouri River and the water-works, it could be successfully accomplished by utilizing the water from Turkey creek. By means of a flushing gate water could be admitted into the sewer in as small quantities as may be desired, or entirely excluded; thence following the center line of Liberty street to the Missouri River. This sewer will drain a much larger area than was previously mentioned, having added to it a great portion of West Kansas and the bluff. There is much to be said in favor of this sewer. It will serve as a main outlet sewer for West Kansas, which they must have shortly, and more than two-thirds of our population would be benefited. In the execution of this work it would not be advisable to arch Turkey creek, thereby making it a part of the sewer. It will be far preferable to keep the sewer entirely separate, excluding the water when necessary and using such quantities as may be required in the flushing process.

The approximate length of this sewer will equal about 14,520 feet. The examination that I have made, not with great precision, however, but sufficiently accurate to establish beyond question its practicability, indicates an inclination from the place of beginning to a point near the corner of Fourteenth and Liberty streets of nearly five inches per 100 feet. From this point to the Missouri River an inclination of nearly three and one-half inches per 100 feet is attainable, which is beyond question sufficient to serve the purpose of its construction. The approximate cost of an improvement of this kind would probably be from $225,000 or $235,000, or about fifteen dollars per foot, first class work. The cost will depend wholly upon the nature and class of woik.

The other method that suggested itself to my mind, and which I communicated to Mr. Knickerbocker, city engineer, during the summer months, who thought favorably of it, is to tunnel through the hill that sepraates the natural basin on the south from the Missouri River on the north. The tunnel will pass directly under the city. The word tunnel, associated with an improvement of this kind, suggests to the mind an extensive and costly work, but in this improvement there will not be so great cost associated with its execution as one naturally supposes.

The tunnel will have a capacity of discharge equal to a circular sewer twelve feet in diameter, through which all sewage and waste from the houses within the area mentioned will pass. There are three routes by which the Missouri River can be reached by means of sewer tunnels. First—Beginning at a point south of Twentieth street near Main, thence to Twentieth, following the same to Cherry street. Thence diagonally under the Fair ground to Ninth street, between Tracy and Lydia avenues. Thence, following as near as possible the ravine, passing under Independence avenue to the river. A considerable amount of work on this route will be open trench work, but the greater proportion will require tunneling. Second route—It is proposed to follow the same route as the former to the corner

of Charlotte and Nineteenth streets. The tunnel will follow the general direction of Charlotte street to Ninth between Charlotte and Holmes streets, thence following as near as possible the direction of the ravines north of Ninth and Independence avenue to Gillis street, thence to the river. There will also be open trench work in this route. Third route—This route begins south of Twentieth street on Main, and follows the general direction of Main street to the Public Square, diagonally across it to Third street, 200 feet or more east of Grand avenue, thence north to the river. I consider this route preferable to the others. In the first place it is shorter and will cost less; secondly, it will at the same time serve the ends of drainage fully as well as the others. The approximate length of this sewer will be 9,017 feet, having an inclination of six inches per 100 feet. At the corner of Twelfth street and Main, the bottom of the tunnel will be 134 feet below the surface. At the corner of Fifth and Main it will be sixty feet below the surface. The tunnel will have a length of nearly 7,400 feet. Open trench work will equal about 1,624 feet. It will be necessary to build two ventilating shafts to provide the sewer with as pure air as possible, and reduce the evil effects of the gases. The approximate cost will not exceed $200,000

It will not be many months before an increased population, building houses in that section of our city, will demand improvements of a sanitary character. The accumulations of waste matter in the area of drainage referred to in the early part of this paper will be very great indeed and they must be relieved from the evil effects of that accumulation. It must be conveyed away so that air and water will be free from contamination. This can only be successfully accomplished by carrying it by means of properly constructed sewers to the Missouri River, either by tunneling or such other method as will fully meet the requirements of the population. There are not a few cities in the United States and Continental Europe that have had to resort to the tunneling process to perfect their sanitary improvements. It is the experience of all cities where these works have been completed that it is far better to carry out a well organized system, even though it may cost more in the first stages of the work, than for the sake of economy to establish little local districts to accommodate every property holder that has some wonderful notion of his own regarding the arrangement of sanitary works. There is no economy in work of that character. It is far better not to begin these improvements at all unless they will in the end be a part of a general system.

AN ENGINEER'S OPINION OF THE TAY BRIDGE.

Mr. E. W. Ives C.E., a well known member of the profession, who was deputed by a number of London railway engineers to make an independent examination into the causes of the Tay Bridge disaster, has presented his report at a meeting held in London.

In the course of this report, Mr. Ives expresses the opinion that the whole bridge was of far too light and flimsy a character, especially the piers, which also

he considers to have been badly designed to resist the under-pressure to which they were subject. He believes that everything was sacrificed to cheapness and facility of construction, and that, in fact, the outlay was pared down to the lowest possible point. His conclusions as to the causes of the accident are that the main girders were not designed to resist the side pressure of the wind; that the method of erecting them strained the wind ties; that there should have been iron cross girders with proper gussets; that the flooring should have been placed diagonally; that there should have been raking columns; the bracing should have been more solid; the top columns should have been tied together; at least two more columns should have been inserted at each pier, and the main girders should have rested directly over the columns, or have had box girders to distribute the weight over them, and not have rested upon a triangular girder in the way they did. He is of opinion that the wind had, previously to the train entering on the large span of the bridge, obtained such a hold upon the girders as to cause them to oscillate considerably, and that the piers, not having proper bracing, rocked until the bolts parted on the weather or southwest side, and caused the whole structure to collapse and fall over.

Mr. Ives, in conclusion, says that, in order properly to investigate the cause of this calamity, the whole of the girders, together with the engine, tender and carriages, should be bodily lifted by means of pontoons, though, if necessary, the girders might be cut into lengths under the water.

It may be stated that Mr. Ives, who has made the above report, is well known as the constructor of several important engineering works, among them being the erection of the unique and immense roof of the Lime Street Station, at Liverpool, covering the largest area of any station in England; the roof at Woodside Station; the Metropolitan Railway works; the bridge near Farringdon Street, and the whole of the large bridges on the Central Railway stations to the Manchester.

—*Oldham Chronicle.*

TURNING SAHARA INTO A LAKE.

It seems that the conversion of the Desert of Sahara into an inland sea might not, after all, be so much of a blessing to the continent of Africa as was claimed when the project was first broached. At a recent meeting of the French Geographical Society at Paris, Dr. Cosson, a member of the Institute, combated the scheme with numerous arguments He did not believe the climate of the interior of Africa would be changed by the artificial sea Its shores would be as arid as those of the Mediterranean in Tripoli; but, if the climate should change, the date crop, which is the principal support of the natives, would be ruined. The routes of the caravans from Tunis and Algiers to the interior would also be destroyed and the whole inland trade degraded. Dr. Cosson also predicted that the mass of water would produce perturbations in the subterranean currents which feed the artesian wells in the oases, and might cause them to fail, and thus entail the loss of hundreds of thousands of palm trees. His views as to the climatic influence of a Saharan Sea were opposed by other members of the society.

EDUCATIONAL.

THE VESTIBULE TO SCIENTIFIC STUDIES.

BY PROF. T. B. SMITH, NORTHFIELD, MINNESOTA.

In all of our teaching, we are too much given to putting a text-book into the pupil's hands and bidding him prepare so many pages for the first lesson. I have become assured that this is not the right course to pursue, and, therefore, at the entrance of each class on any particular branch of learning, I spend a lesson or more, as the case may need, in going as far back as possible and bringing them up to the topic in hand. In this article I shall endeavor to state briefly the method pursued with classes beginning various branches in Natural or Physical Sciences.

It is easy to start with a single thought and unfold it until it becomes very complex; but, if done in the right way, the whole course will appear easy and plain. But to begin with something far removed from the starting point, and try to go ahead without any knowledge of what is behind, is very difficult indeed. If you start at the front door and proceed to pass through the hall and up the stairway, and through the vestibule and over the threshhold into the audience room, then it will be easy to go ahead or to go backward, and there is no sense of bewilderment; but if you be blindfolded and set down at once in the audience room, then you do feel bewildered, for you know not where you are, nor how you came there, further than that you were brought there, nor what is to come.

Let us call any particular branch of Natural Science the audience room; then let us see what constitutes the vestibule through which the pupil must be allowed to pass if you would have him understand clearly where he is and what he is doing.

The first great and fundamental thought is, Our study is to be about matter as it is, as we have been familiar with it all our days. We are not to bother ourselves about its origin or its destiny; neither are we to concern ourselves with Mind. Matter, and all its form and phenomena—these are to be our study.

But Matter is not permanent—it is always changing so far as we can see. So the second great thought is Change.

But there is, as we have learned by experience, always some cause of the change; and these Causes constitute the third great thought.

Summing up what we have thus far learned, we find we are to study and learn about these things:

1. Matter and its Forms.
2. Changes in Matter.
3. Causes of these Changes.

Then follow definitions and divisions of these topics.

I. MATTER.—Matter is that which occupies space and prevents anything else from occupying the same space at the same time. There are large bodies of matter, as the sun, moon, mountains, etc. These are known as *Masses*. Of course, these masses can be divided and subdivided to an apparently unlimited extent. Thus, by heat, water is changed into an invisible vapor; and, by electricity, it is changed into invisible gases. But there is a difference between the invisible forms obtained in the two cases. If the heat be taken away, the vapor produced by it will cool down and again resume its original form; but the gases produced by electricity are permanent—they do not again become water when the electricity is removed. We conclude, then, that the state of division reached by the heat was the finest possible without altering the identity of the water. Such divisions are called *Molecules*, from the Latin word *moleculis*, meaning *a little mass*. But the state of division reached by electricity, by which the identity of the water was altered, must have been finer than the molecules. And, since these particles finer than the molecules cannot be subdivided any farther by the forces at man's command, they are called *Atoms*, from a Greek word meaning *uncut-able*, or *indivisible*.

Then we sum up, in reference to Matter, that we know it in three different forms:

a. Masses.

b. Molecules.

c. Atoms.

II. CHANGES.—As we just now said, in changes identity may be affected or it may not be. So we may classify changes under two heads:

a. *Chemical*, or such as result in loss of identity.

b. *Physical*, or such as do not result in loss of identity, but only affect position, state of rest or motion, condition, as gaseous, liquid or solid, etc.

III. CAUSES OF CHANGES.—Whatever causes change of any kind is called *Force*. We do not know anything about absolute Force; but that is the name we give to whatever causes change. Now Force receives many names, according as it exhibits itself in one way or another; and, without stopping to discuss these "forces," as we call these various exhibitions of Force, we arrange the following classification of them:

1. *Attraction*, which, since it is seen acting between Atoms, and between Molecules, and between Masses, may be divided into three heads:

a. Atomic, usually called Chemical Affinity.

b. Molecular, subdivided into Cohesion, Adhesion, and the Crystallic Force.

c. Cosmical, usually called Gravitation.

2. *Phenomenal*, or such as affect our senses, as Heat, Light, etc.

3. *Biologic*, or *Vital*, or *Life Force*.

Many of these forces can be changed from one kind into another and not one jot of energy be lost; and it is possible, even probable, that most if not all of them are only modes of motion—modes of that motion originally imparted to

matter when "God moved upon the face of the waters"—*i. e.*, the elements of matter.

Thus far we have been getting together the materials with which we are to work. We have now before us Matter and the Forces which act in and on Matter producing changes. Let us, therefore, next endeavor to discover the order in which these changes naturally occur.

In our thought let us go back to "the beginning" of which the Bible speaks. We believe there was a beginning, though we may be wrong. Huxley says: "Any human belief, however broad its basis, is only a probable belief; our broadest generalizations are simply statements of the highest probability."

Now if the simplest form of matter at the present time is the *atom*, then "in the beginning," before molecules and masses were formed, all matter must have been in the atomic condition. These atoms were distributed through all space, and were at rest, unaffected by any force save, perhaps, that universal force whose laws the immortal Sir Isaac Newton formulated—the Attraction of Gravitation, which we have termed the Cosmical Force.

With the idea of Atoms, *at rest and universally distributed*, clearly set before us, then the next question is, How did these atoms get together to form molecules? Well, we may make several hypotheses, which may or may not afford explanation.

First, let us say, the Creator endowed these atoms with peculiar affinities, such that there was immediate attraction between them, and they began rushing together.

Secondly, let us say, the Creator "moved upon the face of the waters," and the atoms rushed together, impelled by peculiarities in "mode of motion."

Thirdly, let us say, the Creator endowed these atoms with peculiar affinities, and then set them in motion, when they at once began to rush together, impelled by these inherent affinities and peculiarities in "modes of motion."

Any one of these may afford the true explanation, but we do not really know. So, since we must make assumptions anyhow, let us not try to offer explanation, but proceed to say that, "in the beginning," the primal form of matter was the Atom, the first active force was atomic attraction, or chemical affinity, and the first result of the interaction of these was the formation of Molecules, in which were seen none of the original properties of the atoms, but entirely new properties.

In these steps we have run one complete round in the transitions of Matter, and hence have set the bounds for what we shall call Kingdom I.

Now, if we take Kingdom I, its atoms, chemism and molecules, and introduce molecular attraction, the result will be masses of matter varying in size from two or more molecules to those huge and wonderful aggregations we term stars and worlds. Molecular attraction exhibits itself in more than one way. If it acts between molecules of the same kind, we call it Cohesion; if between molecules of different kinds, we call it Adhesion. It is a noticeable fact that under some circumstances this molecular attraction causes molecules in their aggregation to as-

sume particular shapes, with well defined angles, called Crystals. To this phase of this force we assign the name, the Crystallic Force. Whether it be a variety of cohesion, or cohesion acting under the direction of a higher force, we do not know.

Both atomic and molecular attraction are influenced, modified and overcome by other forms of force which we have termed the phenomenal, the most important of which in this respect is heat. In the combined action of all the forces thus far mentioned we are to find explanation of the gaseous, liquid and solid conditions of matter and the various specific properties of them. Now we have reached the limit of form and change in dead inert matter and therefore have found the bounds for another kingdom which is Kingdom II. If we take Kingdoms I and II, their atoms, molecules and masses and all their forces, and introduce among them a force called the vital or life force, we have as a result, all the myriad forms of beauty seen in plants and animals.

Like a skillful leader coming into the midst of forces, splendid yet uncontrolled, life comes into the midst of matter and its forms of force, and lo! What evolutions and revolutions! How mightily it sways the scepter of control and bends all under its authority! Yet all the while unconquered powers, only held in temporary abeyance, bide their time and, at the slightest surcease of vigilance on the part of the general, break out and revel in wild riot and ruin. In the forms resulting from the action of the life force, we reach the acme of change in matter. There is nothing beyond this in the material world of which we know aught. Hence we have set the bounds for Kingdom III. Beyond this kingdom there are forces acting in matter, as the mental, the spiritual, the intellectual, but their result is not material and hence we have nothing to do with them. They are beyond the limits of material science. We would only throw out this thought in passing. There is a well known fact learned in the study of Geology, that the life of each historic age gives promise of what is to be in the age succeeding it. So we love to think that the life of man gives promise of a higher and spiritual order of things in the time to come. And from all the beautiful order we have seen in the study of matter and its evolutions, we can not help believing that God's wondrous purposes have had and will continue to have fulfillment in the mighty course of ages.

To study matter further, then, we must take a new material unit, and this shall be our Earth. We study it with reference to the entire contents of Kingdoms I, II and III. By confining ourselves to its exterior and the relations of the land, the water, the air and the living beings, we make limits to our Kingdom IV. But if we go down into the interior and try to find out its birth, growth, history and age, then we call that Kingdom V. And now that the Earth has been ransacked, if we would study matter still further, what is left but the region outside the starry heavens, and this is Kingdom VI, beyond which we can go no further. We have reached the limit. We began with atoms, we end with worlds.

Between these two bounds our senses—the lines by which matter sends messages to mind—receive impressions and we learn therein; but beyond them either way, all is hidden. Just as we abide in silence until vibrations numbering sixteen

per second fall on the ear and we begin to hear sound; and we hear on until the vibrations reach about 40,000 per second, when the ear loses its sensibility, and we pass out into silence again. Just as we abide in darkness until vibrations numbering about 400 trillions per second fall upon the eye when we say we see red light, and we see on through all grades of color until the vibrations reach about 700 trillions per second, when the eye loses its sensibility also, and we pass out into darkness again. Thus we move in little circles of matter having a beginning and an ending, and thus we must be content in our study of matter, to labor within the limits assigned. And why not? Surely this will give us all we can do. In summing up we find there are six kingdoms in material science, viz:

Kingdom I, which deals with atoms, atomic attractions and molecules, and which in the schools is named CHEMISTRY.

Kingdom II, which deals with molecules, molecular attraction and other forms of force and masses, and which is named PHYSICS or NATURAL PHILOSOPHY.

Kingdom III, which deals with everything under the control of vital force, (so called,) and which is known as BIOLOGY, or BOTANY and ZOÖLOGY.

Kingdom IV, which deals with the Earth mainly in a surface view, and which is called PHYSICAL GEOGRAPHY.

Kingdom V, which deals with the Earth mainly in a subterranean view, and which goes by the title of GEOLOGY.

Kingdom VI, which deals with matter extraneous to the Earth, [illegible] goes by the title, ASTRONOMY.

Now all the various branches of material science found in any of our schools may be placed in one or other of these six kingdoms. For instance, Human Physiology belongs in Kingdom III, subdivision Zoölogy; while Meteorology belongs in Kingdom IV, subdivision "Earth in Parts," section "The Air."

I have the whole subject mapped out upon a large chart on which the six kingdoms make a complete circle. As an example of how each kingdom is presented, take Kingdom IV, or Physical Geography:

- PHYSICAL GEOGRAPHY
  - Earth Entire.
    - Celestial.
      - In Universe,
      - In Solar System.
    - Terrestrial.
      - Forms,
      - Density,
      - Magnetism, Etc.
  - Earth Divided.
    - Land.
      - Continents,
      - Islands.
    - Water.
      - Fresh,
      - Salt.
    - Air.
      - Meteorology, Etc.
    - Life.
      - Vegetable,
      - Animal.

This occupies about one-sixth of the circle, the other kingdoms occupying about the same respectively.

Such is the vestibule through which classes in Natural Sciences are inducted into their particular branch by the writer, who has found it great gain so to begin.

ZOOLOGY.

ZOOLOGIZING IN THE MAMMOTH CAVE.

BY H. G. HUBBARD, DETROIT, MICHIGAN.

During the past summer, while acting as entomologist to the Kentucky State Geological Survey, I made, at Prof. Shaler's direction, repeated examinations of the limestone caves in the vicinity of Pennington's Gap in the Cumberland Mountains of Lee County, Virginia, without, however, finding a specimen of any true cave insect, except a cricket (*Raphidophora*). Being dissatisfied with this negative result, and anxious to test my powers in a locality known to be inhabited by blind insects, I determined, on my return, to make a short visit to the Mammoth Cave. Accordingly, on the 19th of August, in company with one other member of the Survey party, I found myself in the stage-coach, rapidly traversing the ten miles of hilly country that intervenes between the railroad at Cave City and this world-renowned cavern. We reached the hotel about six o'clock in the evening, and, after supper, joined a party which we found about to take "the short route," a tour in the cave three and a half miles, and the same distance back, making a walk of seven miles.

We entered the cave, the mouth of which is a little hollow behind the hotel, and, after proceeding about two hundred yards, found ourselves in a very large chamber called the Rotunda. Here two avenues lead off, one to the right, the other to left. The left-hand turn is takeu by all parties making either the "long" or the "short" route, and to the Rotunda they must always return on the way out. The passage to the right is an immense gallery, like a great tunnel, eighty feet wide and forty feet high, and about three miles long. It is called Audubon Avenue, and has but few branch galleries, none of them very long. The first side passage that leaves Audubon Avenue is a mile long, and opens at its end into the top of Mammoth Dome. So one may follow this passage to eternity, by stepping from the top to the bottom of Mammoth Dome, a distance of two hundred and fifty feet.

As I was anxious to begin at once my acquaintance with subterranean life, I decided to remain behind, leaving the guide and his party to continue their route, and arranging to meet them here in the Rotunda on their return at eleven o'clock. I watched their fading lights and listened to the rapidly diminishing sound of their footsteps as they receded down the long passage, then turned into Audubon Avenue, and, following previous instructions, found and traversed to its end the side passage leading to the jump-off into the dome. The gallery was, however, very dry, and, after careful search, finding no insects, I lost no time in returning to the Rotunda. This is also a dry chamber, but in a few places the walls are slightly

moist, and there are ledges upon which the droppings of bats are collected I found at last, on one such moist shelf, a little pile of fresh bats' dung, and, on disturbing it, three or four specimens of *Adelops hirtus* ran swiftly away and hid in the cracks, or in the shadows of small projections of the wall, as though they perceived and shunned the light of my lamp. Their manner was exactly that of a *Catops* when similarly disturbed.

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The next morning my friend N. and I returned to the Rotunda, and found a fresh supply of Adelops, where I had taken them the night before. Other and better ledges also turned up, and we secured in all about thirty specimens of beetles. While examining the side walls, a small patch of clay, adhering to the rock, attracted my attention by its lumpy appearance, and, picking at it, I opened a small pupa, evidently of Adelops. This was a grand discovery, and, while N. made a search for other lumpy patches, I carefully uncovered four cells, all that were found together in this piece. Each cell contained a pupa and I collected them, with the skins of the larvæ. Near by I found another and a third cluster, and N. found one or two more, all within a foot or two of the floor. The number of cells in each cluster varied from four to twelve. One cell inclosed a larva, and two or three others contained recently transformed imagos of *Adelops hirtus*.

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Nearly every part of the Rotunda is dry and devoid of life. The corner in which the Adelops occurred had, however, a slight cave dampness, and so well repaid our search that we devoted the greater part of the morning to examining this recess alone. The carcass of an ox lay here close to the wall and partly buried beneath a heap of stones and earth, though long past the stage of putrefaction—if, indeed, the ordinary process of putrefaction ever takes place in the pure air of the cave—and entirely odorless, the flesh still adhering to the bones in a wet and moldy condition, communicating its moisture to surrounding objects. Upon pieces of wood and boards that lay upon this heap, and were thus kept perpetually moist, we captured seven specimens of *Campodea* and four of *Machilis*, both of which, though blind, had the habits of their relatives, the Bristletails and Poduras, also, five specimens of the blind Pseudo-scorpion (*Chthonius Packardi* Hagen, described and figured in the second part), and two specimens of a transparent and delicate *Psocus*, with small eyes and rudimentary or undeveloped wings. The last is, perhaps, a wanderer from without, but the three former are blind and colorless, true cave forms. The larger cave fly (*Anthomyia*) was common about the ledges, and a single specimen of *Anophthalmns Menetriessii*, which presents an extreme amount of variation, was discovered, after much searching, deeply hidden in a crevice four feet above the floor.

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At noon my friend left me and returned to the hotel. I was too much excited to interrupt this, my first acquaintance with a true cave fauna, and momentarily expected to find a new beetle or to make some other grand discovery. I left

the Rotunda and proceeded along Audubon Avenue perhaps a quarter of a mile to the first sharp turn. Here I heard water dripping at the summit of a long hill of loose rock which rose before me to the roof of the dome. Up this I climbed until I reached the spot upon which the water fell. Most of it sank at once between the rocks and disappeared, but accumulations of sand here and there retained shallow pools, and formed tiny beaches among the fallen fragments. The wet sand was seen at the first glance to be covered with the tracks of insects, as if the hillside swarmed with life. And, in fact, crickets (*Raphidophora subterranea* Scud.) and their young were quite numerous upon the wet stones, although they were congregated in still greater numbers upon the side-walls and roof. Almost the first stone I turned over uncovered an *Anopthalmus*, but it fled like a shadow into a crevice and saved itself. Three or four others, however, shortly fell into my clutches, and then during an hour's hunt I could find no more. My movements had, I suppose, frightened the rest and caused them to seek shelter in the cavities below. I took, however, two specimens of a minute blind spider (*Anthrobia*), which were running upon the sand. I next turned my attention to the pools of water, and, though none of them were larger than an ordinary wash-bowl, I found them all veritable little aquaria, well stocked with the Crustacea described by Packard (*Cæcidotea stygia*). Some of the pools contained twenty or thirty specimens, in all stages of growth. In company with them occurred, not rarely, a leech, or possibly worm, of very slender form, not thicker than an insect pin, but capable of extending its delicate body to a length of two inches. Being almost transparent, these creatures were rendered visible by sheir shadows only.

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The following day we resolved to visit the River Styx, which is the lowest level of the cave and about three miles from the entrance by the route usually taken.

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Arrived at the point where the River Styx crosses the gallery, we found Charon's boat drawn up upon the sand, and, depositing our burdens, we began a search along shore for blind fish and crawfish. The forms of several were soon seen floating like white phantoms in the almost invisible water, and we captured with an insect net several small specimens of both genera of blind fish, *Amblyopsis* and *Thyphlichthys*, which resemble each other closely, but want the ventral fin in the atter genus. We took, also, good specimens of the cave crawfish (*Cambarus pellucidus* Tellk.), and, in addition, a gigantic female of *Cambarus Bartonii*, the common crawfish of the Green River, but which has quite often been found in the cave waters. A very unexpected find, however, was a common frog. He was restinh upon the sand not far from the water, and was somewhat emaciated and apparently much discouraged. A fish with large and perfect eyes, probably a darter, showed itself in one of the large pools. It remained for some time motionless at the surface of the water, within easy reach, but "Pete," our guide,

missed it with the net, and it vanished in a twinkling, not to appear again. A single *Anophthalmus*, found running on the sand, was the only insect, except crickets, seen here.

When, therefore, the party we had left at the hotel in the morning, and who had started later in the day by the long route to the end of the cave, arrived, we decided to accompany them farther. We embarked with them in one of the boats, and, leaving the gallery on our left, pushed under a low, wide arch, and floated for half a mile in an aqueduct, like a mammoth sewer, over water thirty or forty feet deep. The guides, standing up in the bows, propelled the boats by pushing with their paddles against the low roof. At its end, the river sinks beneath the wall of rock, but another great gallery opens here at the side, and another system of halls and avenues begins, the farthest point of which, and the end of the "long route," is still a walk of six miles from the river.

We landed and hurried on before three miles farther, to Washington's Hall, a chamber of the largest size, and for many years the luncheon place for tourists. The floor of the hall is of white gypsum sand, strewn with fragments of the same material. The larger masses of gypsum afford convenient seats and tables for picnickers, and are strewn about with chicken bones and bits of food. The accumulation of such *rejectamenta* is very great; to be reckoned, perhaps, by the cartload; yet, notwithstanding the presence of so much offal, kept perpetually moist by contact with the gypsum sand, not the slightest taint is perceptible in the air of the chamber; only at close quarters the recently deposited morsels give off a peculiarly rancid odor. As before in the Rotunda, I was struck with the conviction that decay in the cave is an exceedingly slow process, accomplished mainly through the agency of a few fungi.* Prof. Tyndall has shown that in the pure atmospthere of the Alps, perishable infusions of meat and vegetables remain unchanged for an indefinite period of time.† May it not be that the equally pure and bracing air of these caverns is likewise comparatively free from the germs of Bacteria, Vibrios and other agents of putrefaction? It has been asserted, by the guides, that meat hung up "at the mouth of the cave" will keep fresh a long time.‡

But, if Bacteria are absent, other scavengers in abundance attack this food material. I found it swarming with larvæ of Adelops and the maggots of a small fly (*Phora*). The imagos of the beetle and the puparia of the fly were also present in countless numbers. The adult beetles were very agile, and, on being dis-

* The fungi of our caves have not, as far as I know, been studied. Two species have been identified by Dr. Farlow from the Mammoth Cave, *Ozonium auricomum* Link, the mycelium of an unknown fungus, and *Stemonitis ferruginea*, also immature. A list by Pokorny, of fungi from the Adelsberg and Lueg caverns, Germany, extracted from Dr. Ad. Schmidt's "Die Grotten und Hoehlen von Adelsberg," Wien, 1854, and kindly sent me by Dr. Hagen, enumerates nineteen species, all found above ground, and originating, as Pokorny thinks, from spores introduced from without on wood.

† For an account of these experiments, see *Popular Science Monthly* for February, 1878.

‡ During the summer months, when the temperature outside is higher than that of the cave (59° F.), a strong current of air flows out of its mouth. The incoming supply is said to be by filtration through the rocks, in which case it would be, very probablv, freed of floating germs.

turbed when gathered in a cluster about a piece of meat, they scattered in every direction over the sand, so that it was difficult to pick them up rapidly. I found the best method to be to throw the lump with Adelops clinging to it on to a handkerchief. The beetles then hid in the folds of the cloth, and could be picked up by a quill passed through the cork of the collecting bottle. In this way we secured several hundred specimens in a few minutes. To secure a good supply of larvæ, it was sufficient to tie up in a cloth one or two small fragments of chicken bone crowded with insects. These, unfortunately, remained forgotten in my collecting sack until after my return home, a week later, when I found and examined them. They were much crushed, and the larvæ all dead, but, of the twenty or more Adelops which adhered to the lumps, and had been imprisoned with them, two were still alive. Both, however, died after another week's confinement. Some of the puparia of the fly were also uninjured, and in a few days several perfect Phoras made their appearance from them. Three or four living mites (*Acarus*), and a very minute Psocid (*Atropos divinatoria* Muell.), possessing eye-spots and undeveloped wings, were also found upon the lumps. Washington's Hall was said to be a good locality for Anophthalmus, but we found only a few specimens under flat pieces of gypsum.

The party of sight-seers had, in the meantime, gone to the end of the cave, and a few minutes before their return "Pete," who had remained with us, proposed to take us to a place where plenty of Anophthalmi could be found. He then led us back a short distance to a passage called Martha's Vineyard. Here the rocks are damp, with some dripping springs, and one quite large pool known as Hebe's Spring. This locality did not disappoint our expectations. It is one of the best in the cave; but, as we had but a few minutes' time, we were obliged to hurry over the ground and could delay but a few moments in one place. The guide, constantly moving on, called back to us that it was dangerous to fall behind. At Hebe's Spring, the repairing of a stairway left the timbers of the former structure scattered about, and under these, *Anophthalmus Tellkampfii* and *A. Menetriessii* were common, the former much more abundant than the latter, however. I found here, under a piece of wood lying on sand, a specimen of a larva which agrees perfectly with Packard's figure of that of *A. Tellkampfii*.* We also secured two specimens of *Phrixis longipes*, the blind Phalangid spider, or Harvestman, described by Cope.†

With a little more time at our disposal, I feel sure that the pupa of Anophthalmus would have been found at this spring, as many of the imagos taken were quite fresh. The pupa has, however, already been figured by Packard in his paper on the beetles of the cave. While I devoted myself to hunting under boards and stones for other insects, taking only an occasional specimen of Anophthalmus, "Pete" and N. were capturing numbers of the latter, all of them resting in exposed places upon the side-walls, where it was quite damp, and usually several feet from the floor. They were not at all difficult to find or to capture, and we took about thirty

* American Naturalist, vol. x, pl. ii.

† Ibid., vi, p. 421.

specimens while rapidly passing over the first half-mile of our route back to the river. * * * * * * * * *

In examining the results of my two days' collecting, I find, in forty specimens of *Anophthalmus Tellkampfii*, but little variation. Of twelve *A. Menetriessii*, three show considerable variation in size and form, and one is plainly pubescent. An undoubtedly new species of this genus has been detected among the specimens of the latter species, which I have named *A. interstitialis*. A small mite (*Acarus?*) infests the bodies of the Anophthalmi. While studying the larva of the *Adelops*, and observing the action of the muscular lobes that close the rectum at the end of the anal tube, by pressure I succeeded in expelling the fœces in ovoidal masses, and along with them several thread-like bodies, curved in the shape of a fish-hook and pointed at the ends. Under a magnifying power of 250 diameters, they appear to be filled with granules, and are thicker and shorter than *Trichina spiralis*. I suspect that they are intestinal worms.—*American Entomologist.*

FISH CULTURE IN THE WEST.

The proposition now before Congress to appropriate $20,000 to enable Prof. Baird and others interested in the artificial propagation of fish to make an exhibit of American food fishes at the International Fishery Exhibition, to be held at Berlin, in April, will at least have the good effect of turning public attention, in this country, to the vast and growing importance of the subject of pisciculture. We do not know that we would gain anything directly by sending our samples to Germany, but as the superiority of our methods would excite remark and stimulate inquiry at home as well as abroad, we might in the end reap a reward in the growth of public interest in this question and the increased willingness of our legislative bodies to make the necessary appropriations for the artificial propagation of food fishes. Wonderful progress has been made in re-stocking waters partially or wholly depleted of fish in many of the Northern States. Artificial propagation has been practiced successfully for many years in the production of salmon and codfish in the New England States, and every spring, millions of the young of these species are turned out of the hatcheries into the bays that indent the eastern coast of Maine, Rhode Island, Massachusetts and Connecticut. Nor have the streams of that region been neglected. Rivers and creeks that for generations had been without fish, have been re-stocked, and thus new and, with proper care, inexhaustible supplies of excellent food have been added to the resources of these States.

The States bordering on the great lakes have for years pursued a most liberal policy in the matter of fish culture. Thirty years ago, Lake Michigan was crowded with the far-famed whitefish, but the eager demands of commerce and the untiring industry of the fisherman made such vast inroads upon the species that it was threatened with utter extinction. About five years ago, at the urgent solicitation of a few naturalists who saw the danger and its remedy, the Wisconsin

Legislature provided for the establishment of a fish hatchery at Milwaukee. Under competent management, the institution has proved a great success, and every year from 10,000,000 to 20,000,000 of young whitefish are turned into Lake Michigan by the hatchers. Careful observations show that the young fish thrive wonderfully, and it will not be long until the supply of commercial whitefish will be greater than ever in Lake Michigan. The same hatchery also turns out millions of lake trout every year. This is a much hardier fish than the whitefish, and its growth is very rapid, but it is not so highly prized as its more delicate neighbor. Within the last two years the propagation of land-locked California salmon has been attended with gratifying success at the Milwaukee hatchery, and it is thought that this valuable fish may become acclimatized in the waters of the Mississippi Valley.

In Michigan, Minnesota and Iowa, as well as Wisconsin, much attention has been paid to the propagation of brook trout, and the cold-water streams of these States are gradually being stocked anew with that delicious fish. It has been found, by experiment, that the whitefish and the lake trout of the great lakes will thrive and increase in the inland lakes of the Northern States which have a depth of fifty feet. These species could hardly be expected to endure the greater warmth of our Missouri summers, but there are others which can be propagated with equally gratifying results, that would, if placed in our running streams and small lakes, add greatly to the natural wealth of the State by vastly increasing our supply of cheap and wholesome food. No State can be too liberal in dealing with this question. There is no other form of animal food that costs so little as fish, and very few that are so nutritious and desirable. We have many streams in this state that might be stocked with food-fishes adapted to our climate at small expense. We are glad to note that our Fish Commissioners are alive to the importance of this subject. They have recently stocked a few streams with young fish procured from Wisconsin, and we have no doubt they would accomplish much more if they were not hampered by the want of funds. We trust that the next Legislature will make up for the shortcomings of the last in this matter.—*St. Louis Globe-Democrat.*

PHYSICS.

CAUSES OF ARTESIAN WELLS.

It has been reported that at Champaign, Illinois, an inexhaustible supply of water has been discovered twenty-seven feet below the surface, and that, on being probed, it overflows at the surface of the earth. Quite similar instances, in various parts of the country, have been numerous. The phenomenon proceeds from the same general cause that sends the millions of springs of water bubbling forth through superficial crevices, and makes some wells constantly overflow. The in-

fluence which produces such action as this is the resultant of the earth's centripetal and centrifugal forces operating impulsively upon the subterranean water deposits, and forcing them into and through the natural channels of the earth's crust. The theory that the water flows to these springs and wells from a higher point, by hydrostatic pressure, is ably contested by a writer in the *Popular Science Monthly*. If the immense floods which break forth in different places were the result of a flow from some other higher bodies of water, the drains must have of necessity sooner or later exhausted the supply sources, unless equivalent streams were flowing into the latter also. Next, whence could come the higher heads to flow into and supply them in turn? Extend the process until a flow is secured from the highest land on the earth, and then whence comes the flow to supply that?

At Grenelle, Germany, a majestic column of warm water rises thirty feet above the surface of a well 1,000 feet deep, for which there is no apparent head. The artesian well at Tours rises with a jet that can sustain a cannon. Chautauqua Lake rises like a jewel in the crown of a high mountain ridge. It is twenty miles long and two miles wide,and is fed by innumerable springs which can be seen bubbling up through the bottom. It is on the highest land in the State of New York west of the Catskill Mountains. From it issues a large mill stream. To account for this great flow in this region by supposing it to fall from some other higher elevation is absurd, for there is no such source from which it could flow without being exhausted.

In the mountain region of Pennsylvania, at every step, the traveler notices abundant streams of the purest water, sometimes gushing from the very tops of the mountains. There is no land above them from which such torrents could flow in such constant abundance.

Lakes Superior, Ontario, Huron, and possibly Michigan, are overflowing springs of subterranean water, but they cannot be accounted for upon the hypothesis of hydraulic pressure,since there are no higher lands which could furnish an adequate supply. If all the lands on the continent which are higher than Lake Superior were supposed to be but shells filled with water, the difference between outflow and the inflow of Lake Ontario would quickly exhaust the supply. The vast surface of Ontario cannot come through an underground channel connecting it with Superior, for the difference in level between the two is 365 feet, and were they connected their surfaces would find a common level.

Lastly, from the highest point of the highest mountains in the world—the Himalayas—great cataracts and streams have poured, and still do pour, with an abundance that not only is astonishing, but would exhaust any possible reservoirs at their extreme tops. The conclusion is inevitable that some other force than hydrostatic or hydraulic pressure exists to which these great overflows are due. Gases are out of the question, for they force water down instead of up, when both are inclosed in a common reservoir.

In the case of water imprisoned within the earth's rocky chambers, the resultant of the two natural forces, centripetal and centrifugal, will be duplicated

upon every point of the rock-prison. The intensity of the resultant will be represented by the aggregation of the resultants of all the particles of water. Suppose a small opening be made in the rock-prison. Immediately the water will be forced out with a velocity equal to the influence of these aggregated resultants, modified by the laws of friction, and this velocity will not be influenced by the direction of the original impulses given to the water particles. Hence, if fissures exist in rocks that lead to imprisoned waters, it would happen that through these outlets the waters must certainly flow. If by any artificial means, as by boring, an opening should be made between a body of confined water and the surface of the earth, a flowing well would result. The intensity of the centrifugal force will increase with the distance from the earth's center, while gravity decreases. Thus we find the strongest and most abundant flows at the tops of mountains or on high plateaus.

But, suppose that it had been fully proved that a particular overflowing well or spring was caused by hydrostatic pressure, it would still remain to be accounted for how the water got to that higher point. This can best be done by the force designated, which is always acting upon the partially confined water-beds and water-channels forming the internal water structure of the earth's crust.

THE AURORA BOREALIS.

PROF. G. T. TEMPLE.

Although the conjecture was hazarded more than 160 years since by Halley, that the aurora borealis was a magnetic phenomenon, it has acquired empirical certainty from Faraday's discovery of the evolution of light by magnetic forces, as well as from more recent observations, the following extracts are translated from a letter written by Herr Pastor emeritus H. M. F. Esmark; having observed the meteorological conditions attending the display of the polar lights for many successive years: "The aurora is neither seen during extreme cold or northerly winds, but appears when an ordinary arctic temperature is raised by southerly and westerly winds, and is generally followed by snow. In the southeastern part of Norway it seems to be especially caused by southeasterly winds, which are there very moist and rather warm. Its appearance is aways accompanied by a falling barometer. In my opinion the phenomenon is due to the following causes: When a wind laden with warmth, moisture, and electricity comes in contact with a body of cold air, the moisture is converted into snow, the warmth and electricity are thereby released, and the aurora is the result of the disturbances. The northern lights can not occur in very high latitudes, because the warm, moist air is cooled long before it reaches them." In this way Herr Esmark would account for the splendid appearance of the aurora in Northern Norway, where the sea winds, bringing warmth, moisture and electricity from the ocean, are met by cold land winds from the interior. MM. Lottin, Bravais, and Siljerstrom, who spent a winter in Bosekop, in Alten (lat. 70° N.), saw the northern lights 160 times in 210 nights. The most vivid aurora that I ever saw near Alten, was toward midnight on the 12th of November, 1874. The flickering lights played about the masthead so like light

ning that it was difficult to believe they were harmless. We had no snow, however, till the evening of the 14th, as we were entering Tromsoe Harbor, and during the discharges of light the compass needle was wildly erratic. The determination of the chemical elements involved, by means of spectrum analysis, is by no means the least of the numerous scientific results to be derived from Arctic exploration. —*Proceedings of the Royal Geographical Society.*

A GLACIER IN THE ROCKY MOUNTAINS.

A gentleman, who has during the past two years, traversed the mountains in the vicinity of Leadville, and penetrated almost every one of the secret recesses, informed a *Herald* reporter yesterday that there is, within twenty-five miles of this city, one of the most interesting curiosities of nature—a veritable glacier, presenting all the characteristics of the glaciers of Switzerland, both in magnitude and motion, its progress being gradually down the gulch. The scene of this curiosity is located in the Mosquito Range, about fifteen miles north of the pass. Our informant states that he first discovered it about three years ago, while out on a prospecting tour. It was nearly a mile in length, and at the bottom of the gulch presented a sheer precipice of ice not less than 150 feet in height. Later in the season the place was visited again, when it was found that the mass of ice had melted until at its face it was not more than one hundred feet high, the loss from the surface reducing its length to about half a mile. Again, early the following year the place was visited, and the glacier was found to have regained its bulk, showing that the accumulation of ice and snow during the winter was about one-third its gross bulk. The rocks on the sides of this immense mass of ice show the marks of attrition, proving beyond all controversy that the glacier is in motion. Indeed, the earth at the foot of the gulch, heaved up in great masses, shows that it is gradually moving down into the valley. During the summer, a large stream of water flows from the face of the icy cliff. Our informant is of the opinion that the glacier, as it progresses out of the deep gorge in which it was formed will slowly melt away and it will not last many years. It is out of the way of ordinary travel, and the route to the scene is exceedingly difficult, so that it is not likely to be visited except by prospectors and hunters.—*Leadville Herald.*

METEOROLOGY.

MISSOURI WEATHER SERVICE, JANUARY 1880.

PROF. FRANCIS E. NIPHER, WASHINGTON UNIVERSITY, ST. LOUIS, MO.

At the Central Station, January has been very warm, with excess of rain. The normal January temperature is 31.7 °, while the temperature of January, 1880, was 46 °, or 14.5 ° above the normal. In no case during the month did the *mean daily temperature fall to the normal* temperature, and in only six cases did the

daily *minimum* reach this temperature. On only eight days did the daily *temperature* fall below 40°. The coldest day (31st,) had a mean temperature of 33.5, and its minimum, the coldest of the month, was 22.5. The highest temperature of the month, was 67 on the 11th. In 1864, Engelman observed a January temperature of 72, but the mean monthly temperature was 29°, the coldest temperature of that month being minus 22.5. Not only has the past month been 5° warmer than any other January in forty-three years, but it has been very uniform Vegetation near St. Louis is, nevertheless, little affected, and the fruit buds are, as a rule, safe as yet. The silver-maple is reported in bloom at Allenton, (St. Louis county). In the southern part of the state, vegetation has been advanced, and may receive injury from future cold weather. The rainfall has been least, (less than one inch,) in the extreme northwest, and in the large area drained by the Osage and Gasconade rivers and their tributaries, and extending up the Missouri as far as Glasgow. In the extreme southwest, the rainfall has reached between six and seven inches. Marble Hill, (in the southeast,) reports three inches of snow on the 12th, but at no other station has the snowfall of the month exceeded one-tenth of an inch.

KANSAS WEATHER REPORT FOR JANUARY, 1880.

BY PROF. F H. SNOW, KANSAS STATE UNIVERSITY.

The warmest January, and, except December, 1877, the warmest winter month in our thirteen years' record. The month was also remarkable for the entire absence of snow, and the unprecedented number of fogs. The high temperature has caused many insects to come forth from their winter quarters, including bees, flies, beetles and moths. Our fruit-growers should search for and destroy the wingless females of the canker-worm moth, which, in a few localities, are now depositing their eggs upon the apple trees.

Mean temperature, 41.23 degrees, which is 14.84 degrees above the average January temperature of the twelve preceding years. The highest temperature was 67 degrees, on the 18th; the lowest was 20.5 degrees, on the 31st; monthly range, 46.5 degrees; mean at 7 a. m., 35.37 degrees; at 2 p. m., 48.42 degrees; at 9 p. m., 40.64 degrees.

Rain, 1.80 inches, which is 0.51 inches above the January average. Rain fell on 3 days. There was no snow, but a small amount of sleet preceded the rain of the 29th.

Mean cloudiness, 48.49 per cent of the sky, the month being 0.64 per cent cloudier than the average. Number of clear days, 15 (entirely clear, 2); half clear, 7; cloudy, 9 (entirely cloudy, 7). Mean at 7 a. m., 59.05 per cent; at 2 p. m., 41.29 per cent; at 9 p. m., 45.16 per cent.

Wind—southwest, 25 times; northwest, 24 times; southeast, 13 times; northeast, 12 times; north, 3 times; south, 8 times; east, 6 times; west, twice. The entire distance traveled by the wind was 12,861 miles, which gives a mean

daily velocity of 414.87 miles, and a mean hourly velocity of 17.28 miles. The highest velocity was 55 miles an hour, at 1 p. m., on the 21st.

Mean height of barometer, 29.094 inches; at 7 a. m., 29.115 inches; at 2 p. m., 26.067 inches; at 9 p. m., 29.100 inches. Maximum, 29.631 inches, at 9 p. m. on the 12th; minimum, 28.604, at 9 p. m. on the 10th; monthly range, 1.027 inches.

Relative humidity—mean for the month, 73.8; at 7 a. m., 84.3; at 2 p. m., 57.3; at 9 p. m., 79.9; greatest, 100, on 12 occasions; least, 29.2, at 2 p. m. on the 14th. There were 9 fogs, all in the first quarter of the month.

The following table furnishes a comparison with former years:

JANUARY.	Mean temperature.	Maximum temperature.	Minimum temperature.	Rainfall, in inches.	Mean Cloudiness.	Mean Humidity.
1868	23.67	64.0	*–7.0	0.36	37.00	. . .
1869	30.50	56.0	6.0	2.90	43.97	83.7
1870	29.43	56.5	–1.0	0.67	49.25	74.2
1871	28.86	67.5	–5.0	1.11	64.00	75.7
1872	24.35	50.5	–7.5	0.17	42.69	68.3
1873	18.61	46.5	–26.0	2.66	47.10	75.5
1874	28.01	61.0	–2.5	2.35	53.65	73.0
1875	15.60	44.0	–18.5	0.12	54.84	83.1
1876	34.70	65.5	–2.0	0.57	42.17	68.4
1877	25.60	62.5	–9.0	1.17	48.82	75.5
1878	33.97	55.0	7.5	3.05	46.77	73.4
1879	23.49	53.0	–16.0	0.37	43.98	76.0
1880	41.23	67.0	20.5	1.80	48.49	73.8
Mean of 13 Januaries.	27.54	57.6	–4.6	1.33	47.90	75.0

*The minus sign indicates temperature below zero.

KANSAS METEOROLOGICAL SUMMARY FOR THE YEAR 1879.

BY PROF. F. H. SNOW, KANSAS STATE UNIVERSITY.

The chief characteristics of the weather of 1879 were the high average temperature of the spring and autumn months, the long period of immunity from severe frosts, the deficient rainfall of March, May and August, the extraordinary rainfall of November, and the low percentage of cloudiness. It is worthy of note that, notwithstanding the deficiency of rain in the months above named, the crops have been abundant in all the agricultural sections of the State.

TEMPERATURE.

Mean temperature of the year, 54.67 degrees, which is 1.51 degrees above the mean of the eleven preceding years The highest temperature was 99.5 degrees, on August 4; the lowest was 16 degrees below zero, on the 4th of January,

giving a yearly range of 115.5 degrees. Mean temperature at 7 a. m., 48.61 degrees; at 2 p.m., 63.71 degrees; at 9 p.m., 53.18 degrees.

Mean temperature of the winter months, 27.93 degrees, which is 1.94 degrees below the average winter temperature; of the spring, 58.4 degrees, which is 4.83 degrees above the average; of the summer, 76.5 degrees, which is 0.47 degrees below the average; of the autumn, 56.71 degrees, which is 3.90 degrees above the average.

The coldest month of the year was January, with mean temperature 23.49 degrees; the coldest week was January 2d to 8th, with mean temperature 3.9 degrees; the coldest day was January 3d, with mean temperature 9.3 degrees below zero. The mercury fell below zero 13 times, of which 10 were in January and 3 in December.

The warmest month was July, with mean temperature 79.14 degrees; the warmest week was July 3th to 11th, with mean temperature 83.54 degrees; the warmest day was July 22d, with mean temperature 86.9 degrees. The mercury reached or exceeded 90 degrees on 48 days, viz.: 4 in May, 12 in June, 16 in July, 14 in August, and 2 in September.

The last light frost of spring was on April 18th; the first light frost of autumn was on October 10th, giving an interval of 184 days entirely without frost. The last *severe* frost of spring was on April 4th; the first severe frost of autumn was on October 24th, giving an interval of nearly 7 months (203 days) without severe frost.

The severe cold weather of January and the frost of April 3d were very destructive to the buds of peaches, pears and early apples, in many localities; but there was generally a fair crop of small fruits and winter apples.

RAIN.

The entire amount of rain, including melted snow, was 32.68 inches, which is 2.70 inches below the average annual amount for the 11 preceding years. Either rain or snow fell on 90 days, 12 less than the average. The longest interval without rain during the growing season (March 1st to October 1st) was 19 days, from April 30th to May 19th. The number of thunder showers was 36, of which 9 were in June and 1 in December. There were 5 light hail storms.

SNOW.

The entire depth of snow was 10.35 inches, of which 0.85 inches fell in January, 4.50 inches in February, 2 inches in November, and 3 inches in December. The last snow of spring was on February 25th; the first snow of autumn was on November 28th.

FACE OF THE SKY.

The average cloudiness of the year was 40.01 per cent, which is 4.75 per cent below the average. The number of clear days (less than one-third cloudy) was 179; half clear days (from one-third to two-thirds cloudy), 114; cloudy (more than

two-thirds), 72. There were 61 entirely clear and 35 entirely cloudy days. The clearest month was August, with an average cloudiness of 28.92 per cent; the cloudiest month was December, with an average of 51.83 per cent. The mean cloudiness at 7 a.m. was 44.09 per cent; at 2 p.m., 46.27 per cent; at 9 p.m., 29.67 per cent.

DIRECTION OF THE WIND.

During the year—three observations daily—the wind was from the southwest 272 times; northwest, 238 times; southeast, 158 times; south, 130 times; northeast, 112 times; east, 90 times; north, 71 times; west, 16 times; calm, 8 times. The south winds (including southwest, south and southeast) outnumbered the north winds (including northwest, north and northeast) in the ratio of 560 to 421.

VELOCITY OF THE WIND.

The number of miles traveled by the wind during the year was 124,768, which is 14,160 miles less than the average for the past 6 years. This gives a mean daily velocity of 341.83 miles, and a mean hourly velocity of 14.24 miles. The highest hourly velocity was 60 miles, on February 25th and March 13th; the highest daily velocity was 960 miles, on March 8th; the highest monthly velocity was 13,787 miles, in March. The three windiest months were March, November and December; the three calmest months were June, July and August. The average hourly velocity at 7 a. m. was 12.78 miles; at 2 p. m., 16.39 miles; at 9 p. m., 14.03 miles.

BAROMETER.

Mean height of barometer column, 29.127 inches; at 7 a. m., 29.150 inches; at 2 p. m., 29.103 inches; at 9 p. m., 29.126 inches; maximum, 29.745 inches, on January 3d; minimum, 28.534 inches, on December 28th; yearly range, 1.211 inches. The highest monthly mean was 29.253 inches, in January; the lowest was 29.074 inches, in May. The barometer observations are corrected for temperature and instrumental error.

RELATIVE HUMIIDITY.

The average atmospheric humidity for the year was 67.13; at 7 a. m., 77.86; at 2 p. m., 50 11; at 9 p. m., 73.41. The dampest month was January—mean humidity, 76; the dryest month was March—mean humidity, 56.1. There were 10 fogs during the year. The lowest humidity for any single observation was 12.3, at 2 p. m. March 9th—less than one-eighth of saturation.

The following tables give the mean temperature, the extremes of temperature, the velocity of the wind, the percentage of cloudiness, the relative humidity, and the rainfall, for each month of the year 1879, and a comparison with preceding years:

MONTHS.	Mean temperature.	Maximum temperature.	Minimum temperature	Miles of Wind.	Mean Cloudiness.	Relative Humidity.	Rainfall, in inches.
January . .	23.49	53.0	−16.0	8,309	43.98	76.0	0.37
February. .	34.06	74.0	5.0	10,097	39.04	64.7	0.41
March. . .	48.22	87.0	11.0	13,787	46.02	56.1	0.37
April . . .	56.40	84.0	20.0	11,231	49.67	61.0	4.18
May . . .	69.50	93.0	43.0	12,057	37.20	60.9	1.60
June . . .	73.22	97.0	45.0	9,498	41.33	69.9	7.14
July . . .	79.14	97.5	62.5	6,980	34.89	73.8	3.66
August . .	75.78	99.5	49.0	6,815	28.92	63.8	1.03
September .	65.40	92.0	42.0	10,237	37.00	64.0	3.57
October . .	60.46	87.5	25.5	10,952	31.94	71.2	2.81
November .	44.26	76.5	16.0	11,964	38.33	70.6	5.15
December .	26.23	65 5	−9.0	12,821	51.83	74.0	2.39
Mean . . .	54.67	83.8	24.5	10,397	40.01	67.1	2.72

COMPARISON WITH PREVIOUS YEARS.

YEAR.	Mean temperature	Maximum temperature.	Minimum temperature.	Miles of Wind.	Mean Cloudiness.	Relative Humidity.	Rainfall, in inches.
1879 . . .	54.67	99.5	−16.0	124,768	40.01	67.1	32.68
1878 . . .	55.33	98.0	−6.0	125,793	40.65	70.4	38.39
1877 . . .	54.16	99.0	−9.0	113,967	47.12	72.6	41.09
1876 . . .	52.76	98.0	−5.0	148,120	41.27	66.8	44.18
1875 . . .	50.60	99.0	−16.5	145,316	44.81	65.5	28.87
1874 . . .	54.20	108.0	−3.0	145,865	45.54	65.5	28.67
1873 . . .	52.71	104.0	−26.0	154,508	42.46	64.0	32.94
1872 . . .	51.90	97.0	−18.0	. . . .	44.33	64.4	32.63
1871 . . .	54.30	103.0	−6.0	. . . .	47.37	. . . .	33.23
1870 . . .	54.50	102.0	−10.0	. . . .	47.88	68.4	31.38
1869 . . .	50.99	96.0	−5.0	. . . .	49.23	. . . .	38.51
1868 . . .	53.36	101.0	−16.5	. . . .	42.35	. . . .	37.42

In presenting this report, the writer desires to acknowledge his indebtedness to Prof. H. S. S. Smith, for taking the observations during seven weeks' absence during the summer vacation.

RELIABILITY OF THE WEATHER PREDICTIONS OF THE U. S. SIGNAL SERVICE.

It is quite wonderful to observe the success of the "simultaneous observations" plan of the U. S. Signal Service, as shown by the verifications of the weather predictions of the bureau. The detailed comparison of the tri-daily indications for January, with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of verifications to be 84.4 per cent. The

percentage for the four elements are: Weather, 86.9; Direction of the Wind, 83.2; Temperature, 84.5; Barometer, 82.7 per cent. By geographical districts they are: for New England, 85.8; Middle States, 85.8; South Atlantic States, 84.4; Eastern Gulf States, 80.7; Western Gulf States, 80.7; Lower Lake region, 84.3; Upper Lake region, 87.8; Tennessee and the Ohio valley, 84.9; Upper Mississippi 90.3; Southern Pacific coast region, 96.0. There were 10 omissions to predict out of 3,813, or 0.26 per cent. Of the 3,803 predictions that have been made, 156, or 4.10 per cent. are considered to have entirely failed; 129, or 3.39 per cent. were one-fourth verified; 471, or 12 39 per cent. were one-half verified; 421, or 11.07 per cent. were three-fourths verified; 2,626, or 69.05 per cent. were fully verified, so far as can be ascertained from the tri-daily weather maps.

160 Cautionary Signals were displayed during the month, of which 119, or 74.4 per cent. were justified by winds of 25 miles per hour, or over, at, or within the radius of 100 miles of the station. Forty-six Off-shore Signals were displayed, of which 40, or 87.0 per cent. were fully justified; 42, or 91.3 per cent. were justified as to direction; 41, or 89.1 per cent. were justified as to velocity; and 3, or 6.4 per cent. were not justified either as to direction or velocity. Twenty-nine of the Off-shore were changed from Cautionary. 206 Signals of both kinds were displayed, of which 159, or 77.0 per cent. were fully justified. The above does not include signals ordered for fifty display stations, where the velocity is only estimated. Forty-eight cases of winds of 25 miles and over per hour, from scattering stations, were reported, and for which signals had not been ordered. Eight signals were reported late.—*U. S. Monthly Weather Review.*

CHEMISTRY.

ANNUAL ASSAY AT THE UNITED STATES MINT.

The annual assay of the coinage at the three mints of the United States was begun in Philadelphia recently by the commissioners appointed by President Hayes to examine and test the fineness and weight of the coins made during the past year.

The "reserved" coins, representing one of every denomination struck off on every working day of the past year, were brought out, tied up in small packages, and opened by the Commission—first, the gold coins from the mint at Philadelphia; second, the silver coins; third, the gold coins from the mint at San Francisco; fourth, the silver coins of the same city; fifth, the gold coins from the mint at Carson. and, sixth, the silver coins from the same depository. Two committees were appointed by the Chair, one to take charge of the weighing and the other the assaying.

After arrangements had been completed for the weighing and assaying, the

reserved gold coins are placed in a black-lead crucible and covered with borax, to assist the fluxing and to prevent the oxidation of the copper alloy. They are then melted down and stirred, by which a complete mixture is effected, so that an assay piece may be taken from any part of the bar cast out. The piece taken for the purpose is rolled out for convenience of cutting. It is then taken to an assay balance (sensible to the 10,000th of a half-gramme or less), and from it is weighed a half-gramme, which is the normal assay weight for gold, being about 7.7 grains Troy. This weight is stamped 1,000, and all the lesser weights (afterward brought into requisition) are decimal divisions of this weight, down to one ten-thousandth part.

Next, silver is weighed out per the quartation, and as the assay piece, if standard, should contain 900 thousandths, of gold, there must be three times this weight, or 2,700 thousandths of silver, and this is accordingly the quantity used. Thin sheets of lead for cupellation are cut into square pieces and rolled into the form of a hollow cone, and into this are introduced the assay gold and the quartation silver. The lead is then closed around them and pressed into a ball. In the furnace are placed the cupels, and into one of them is deposited the leaden ball with its contents, after which the furnace is closed. When the cupellation has been finished, the metal is allowed to cool slowly, and the disk or button which it forms is detached from the cupel. With a hammer the button is flattened and afterward annealed by bringing it to a red heat. It is then laminated by passing it between rollers, is again annealed, and is rolled loosely into a spiral, or coil, called a cornet. It being ready for the process of quartation, it is placed in a matrass containing about 1¾ ounces of nitric acid, and in that it is boiled ten minutes, as indicated by an electric monitor. The acid is then poured off, and three-fourths of an ounce of stronger acid at thirty-two degrees is substituted for it, in which the gold is boiled ten minutes more. Again the acid is poured off and another boiling in equally strong acid is had. The silver having thus been removed, the gold is taken out, washed in pure water and exposed in a crucible to a red heat for the purpose of drying, strengthening, and annealing. The cornet of gold is placed in the assay balance, and the number of thousandths which it weighs expresses the fineness of the gold assayed in thousandths.

The method employed for testing the accuracy of the process is as follows. A roll of gold of absolute purity, which has been kept under the seal of the Chairman of the Assay Commissioners, is opened in their presence, and from it is taken the weight of 900 parts. To this are added 100 of copper, to make up 1,000 parts of the exact legal standard. The same process is employed as with the other gold, and at the same time after the assay is finished, the pure gold remaining ought to weigh exactly 900. The law allows a deviation one-thousandth for gold coin; that is, from 899 to 901.

In assaying the silver, the reserved coins are melted together in a black-lead crucible, to prevent oxidation and to allow of dipping out. A small portion is poured into water, producing granulation, from which portion the assay is taken.

A different mode is pursued with silver, for the reason that, when silver is alloyed with copper, there is a separation to a greater or less degree between the two metals in the act of gradual solidification. From the sample the weight of 1,115 thousandths is taken, which is dissolved in a glass bottle with nitric silver. Into this solution the large pipette full of standard solution of salt is introduced, and immediately a white precipitation is formed, which is the chloride of silver, and and contains of the metallic silver 1,000 parts. The bottle is violently shaken by a mechanical arrangement, and so continues to be shaken, until the addition of salt water only shows a faint trace of chloride below the upper surface of the liquid. In making the test assay a roll of silver of known absolute purity is kept from year to year under the seal of the Chairman of the Commission. This is opened, and 1,004 parts weighed off and submitted to the same process as employed with the coin. If the salt water used be of the exact standard, the solution in the larger pipette will precipitate 1,000 parts of silver; four measures of the decimal solution will be required to precipitate the remaining four parts. The assay will be finised to-day.—*Philadelphia Press.*

THE DIAPHOTE.

The Diaphote is an instrument by which you can see by telegraph. Dr. H. E. Licks, of Bethlehem, Pennsylvania, has invented an instrument which he calls by this name, from two Greek words, *dia*, through, and *phos*, light. He read a paper in Reading, the other day, and exhibited his instrument. This consists of a receiving mirror, the wires, a battery, and a reproducing speculum. The receiving mirror is an amalgam of selenium and iodide of silver; the reproducing speculum is a compound of seleninm and chromium. The wires are numerous, as it is necessary to distinctness that a wire should not be required to affect but a very small space. The instrument exhibited had a mirror six inches by four, composed of seventy-two small plates, to each of which a wire was attached, the whole being wrapped by a fine insulated covering. These wires run to a common galvanic battery and thus connect with the reproducing plate. When the circuit is closed, the rays of light are conducted through an ordinary camera, and the accompanying heat produces chemical changes in the amalgam of the mirror, which, modifying the electric current, cause similar changes in the reproducing speculum.

In the experiments at the close of the explanatory lecture, an instrument was taken to a lower room of the building and operated from there to the stage in presence of the audience. Before the mirror in the lower room the committee held in succession an apple, a pen knife, and a trade dollar, which were distinct on the platform above. The date on the trade dollar, thrown on an enlarged screen, was plainly visible, as well as the goddess of liberty. A watch was next used, and the audience could see the movement of the hands. An ink bottle, a flower, parts of a theater hand-bill, were also shown, and when the head of a live

kitten was exhibited, there was great applause, and the inventor warmly congratulated on his success. The Reading *Eagle*, from which we condense this account of the remarkable invention, represents the opinions entertained of its practical value as very high—it being possible for a signal officer on a railroad to see hundreds of miles of track at the same instant. What next?—*Kansas City Journal.*

SCIENTIFIC MISCELLANY.

CANAL ACROSS CENTRAL AMERICA TO THE PACIFIC.

BY E. H. DERBY.

The success of the Suez Canal insures the construction of another ship canal, most important to the United States—one which will form a new route for our coastwise commerce, which now passes around Cape Horn to the Pacific. It will reduce a voyage of 18,000 miles to one less than one-third of that distance, and diminish the time required on the way to one-fifth of the time now taken, replacing the vessel under sail with the steamship of steel. The Pacific railways are adapted to transportation of mails, travelers, and express freight. They are important also for local traffic, but in no respect suited to our chief coasting trade—the conveyance of grain, provisions, timber, coal, fish, and metals between the Atlantic and Pacific. When a ship canal is finished, it will cheapen all our routes to the Pacific, and it is safe to predict that it will reduce the rates of freight between the Atlantic and the Pacific below six dollars per ton, *via* the canal, and we may easily foresee what will be the future course of commerce. The routes across the Isthmus and Central America have been explored and surveyed by both England and the United States, and the estimates for one of them are below the cost of the Suez Canal, while the prospects of business are far more encouraging. The Suez Canal commands the trade between India and Europe, but cannot control the commerce of China and Japan with the United States, or more than half of that between the same countries and Europe, while a ship-canal between the Gulf of Mexico and the Pacific will eventually command twice the tonnage that now passes through the Suez Canal.

It will be a candidate for the vast export of wheat and other grain from our Pacific coast to Europe. The annual production of wheat on our Pacific coast exceeds a million tons, and will soon require a million of tons of shipping to convey it to Europe. The ships would pass twice through the canal, and give it two millions of tonnage. The vast coasting trade of the United States between the Atlantic front and California, Oregon and Alaska would pass through this canal both going and returning, and the varied products of the Pacific coast, in the shape of timber, fish, copper ore, and extent of cargoes would, together, add another

nillion to its tonnage. The commerce of the United States alone through this canal will supply a tonnage equal to that which pays six millions of dollars each year to the Suez Canal. It will be a candidate for ships on their voyages from Europe for tea to China and Japan, and on their return, and will take nearly the whole tonnage passing between the Atlantic States, China, Japan and the Philippine Islands, and between Europe and the Russian Possessions, and best accommodate the ships engaged in the whale fisheries of the Pacific. Tea, to the extent of two hundred millions of pounds, and occupying one hundred thousand tons of shipping, forms one item of its commerce, which will annually send through the canal nearly a quarter of a million tons of shipping. Then we have the trade between Australia and Europe, one item of which—wool—amounts yearly to three hundred millions of pounds. We may safely calculate that the Australian ships, out and back, will patronize this canal to the amount of three hundred thousand tons.

Peru, with it guano amounting to three or four hundred thousand tons sent annually to Europe; Chili, with its copper and nitrates and return cargoes, with Gautemala, Mexico, and Central America, must furnish at least another million of tons. Then we have the growth of this commerce while the work progresses, together with that due to new facilities, so that the aggregate must reach between five and six millions of tons—nearly twice the tonnage which passes yearly through the Suez Canal. This estimate is not a high one. Ten years since, before the grain trade of California had attained to any importance, the tonnage that would seek the canal was set at 3,300,000 tons by Admiral Davis, of our navy, and the annual saving in cost of freight, interest, and insurance on the property to be transported by this canal, was set by him at ninety-nine millions of dollars.

The estimate seems to be a high one, for it exceeds the computed cost of the canal itself; but the saving must be immense, as this trade is fast increasing, and the cost of transportation may be lessened two-thirds by a ship canal. California has become the chief granary of Great Britain, which now requires annually from other nations two hundred millions of bushels of grain. She prefers the wheat of California to grind with her own moist wheat, and there is no country but California where one man can successfully cultivate five hundred acres of wheat unaided by either man or fertilizer.

With this canal completed, the grain of San Francisco, which is now more than four months on its way to Boston or Liverpool, could be landed there in less than three weeks. The vessel transporting it, instead of making one trip yearly, would accomplish many trips, by the aid of steam, now prohibited by the length of the voyage.

To the United States the canal will be most useful in developing the products of the Pacific coast and exchanging them for our manufactures. To the British Isles it is even more important, as they draw one-fifth of the wheat they consume from California and Oregon, and by means of this canal may save annually a million sterling in freight.

To France it is important for the diffusion of her manufactures over the isles and coasts of the Pacific, while the whole continent of Europe and most of South America are deeply interested in this enterprise.—*Harper's Magazine for March.*

ANCIENT EGYPT.

BY FRANCIS E. UNDERWOOD.

The history of Egypt can never be fully known, although its memorials are more numerous and more profoundly interesting than the remains of any other ancient civilization. No other people ever took such pains to perpetuate their annals. Every one of their temples and colossal sculptures, as well as their eternal pyramids, seems to have been designed to preserve the name of a Pharaoh and the events of his reign. Mounds of stone along the Nile, and by its old and deserted channels in the Delta, designate the sites of dead and forgotten cities; and every column and pedestal and fragment of wall still bears the indestructible characters which tell of the pride and power of some successor of Amon-ra.

The ruins of Egypt, beyond all others on the planet, show grandeur of design with adequate skill and boundless energy in execution. To an Egyptian architect nothing was impossible. We are not losing sight of the works of the Greeks; but the art and architecture of that lively and accomplished people have been so long domesticated in modern life and blended with modern thought that they give us an impression of elegance and proportion, of refined and tranquil beauty, but never the sense of sublimity. The central idea in Egypt was an all-compelling power, finding expression in original and tremendous forms. The Hall of Columns at Karnak, and the gigantic twin statues of Amen-hotep III, are instances of the purely sublime.—*March Atlantic.*

WONDERS OF THE VATICAN.

BY EMILY F. WHEELER.

The Vatican, then, is an immense and irregular pile of buildings, erected at different times, and with little attempt at architectural unity. It consists of countless halls and rooms, and these surround courts with colonnades and fountains. Many of them are lighted from above; but others, especially in the library, look out on sunny garden spaces where are close-clipped hedges, trim flower-beds, and orange and lemon trees laden with golden fruit. The halls, given up to statues and pictures—and there is half a mile of them, according to Murray—are cold and stately in their effect; and, despite a *scaldino* here and there, they chill one to the morrow of his bones in half an hour. The Etruscan and Egyptian museums beneath are gloomy, but the library halls are warm and bright. Their walls are adorned with frescoes, their doorways and columns are of marble in all varying

ints. The book-cases are of rare woods, some paneled and carved, some painted with fruit and flower designs on a white or gold ground. These are all you see, the books being invisible. Rare, marble tables hold presents made the popes by kings and emperors in the last century—Sèvres vases from the King of Prussia; malachite from Prince Demidoff; splendid candelabras from Napoleon I; little Prince Louis' baptismal font, sent by Eugenie so long ago; rare illuminated missals, whose covers are adorned with embroideries of gold and gem; a wonderful fald-stool from Tours, a mass of delicate carving in light brown wood, all ferns and wandering vines and bell-flowers, and lace-like canopies over ivory saints six inches high which jewel the sides—all these are but a little of the beautiful things you see. You walk through hall after hall filled with rich and rare and curious articles, and get from every window glimpes of garden green or silvery fountain. You look back from the last hall down a vista so long that you cannot distinguish objects at the other end. The whole effect is of bewildering richness and beauty. But all these museums are much alike, I suppose, to ignorant eyes. The first one seen always stays in your memory as biggest and best.—*Good Company, No. 6.*

MANUFACTURE OF GOLD LEAF.

Gold beating appears to be one of the manipulations in the arts that cannot be successfully imitated by machinery. Numerous attempts have been made to substitute machinery for hand labor, in what appears to be the merely mechanical work of beating, but hitherto without success. All the work of making gold leaf or foil from the ingot or bar is hand labor, with the single exception of the rolling preparatory to beating.

The gold is procured usually at the United States assay office in New York, its purity being "99 fine." For dental purposes even this hardly appreciable alloy must be elimminated; gold foil for filling carious teeth being absolutely pure gold, or as nearly pure as possible. For gilding purposes the purity of the metal varies with the use to which it will be assigned, and its color is also varied to suit tastes or for particular purposes, by the use of silver or copper as an alloy.

When the gold is rolled as thin as practicable between highly finished and hardened steel rollers, the ribbon thus made—about seven-eighths of an inch wide—is cut into squares, each one of which is placed between layers of "gold-beater's skin," an extraordinarily thin parchment, until a pile several inches high, or thick, is made. This pile is then beaten with an iron hammer, with slightly convex faces, on a block or an anvil of marble. In this beating is comprised nearly all the particular art of this manufacture. The hammers used are of different weights in the different stages of the process, the heaviest weighing about twenty pounds each. The leaves in the pack have to be occasionally changed in position, those nearest the outside changing place with those in the center as it is a singular fact that those in the center are widened and thinned much more rapidly than those that come immediately under the face of the hammer. When the leaf is

beaten sufficiently thin it is cut by girls into squares of four inches, and each laid placed between the leaves of proper books having red chalk—argillaceous red oxide of iron—rubbed on them. The leaf is cut by a splint of bamboo or cane, the outer or silicious portion forming an edge quite superior to that of steel for the purpose. The process of the silver plate for silvering is similar to that for making gold leaf. The metals are melted in crucibles of Stourbridge clay which are used only once and then broken up and sold with the sweepings of the shop, which bring from $40 to $60 per barrel, according to the amount of the precious metals extracted. A singular fact connected with gold beating is that all the finer gold-beater's skins used in Europe or this country are made by one house in England, the secret of their preparation having been kept in the family for several generations.—*Boston Journal of Commerce.*

BIBLE DATES AS ESTABLISHED BY EGYPTIAN MONUMENTS.

REV. JAMES FRENCH.

Chevalier Bunsen, in his work on Practical Corollaries, says: "The only chronology adapted to Universal History is that according to years before and after Christ." Jewish history counts from Christ backward through the line of Jewish Kings. Now it is a remarkable fact that monumental history synchronizes with Jewish history as recorded in the Bible.

One instance, that of Schishonk, King of Egypt, plundering Solomon's temple during the reign of Rehoboam about B. C. 974, we have alluded to in a former article. This is recorded in the temple of Karnac. Schishonk belonged to the 22nd dynasty. There is another record which places Pharaoh Hophra, the 4th King of the 26th dynasty, as contemporary with Zedekiah and Jeremiah, about B. C. 586. Here is a definite period of less than four centuries, extended over four Egyptian dynasties from the 22d to the 26th inclusive.

Bunsen calls these two cases where monumental and Bible history synchronize with scientific exactness, "interesting points of contact." He says the scripture data accord on the most satisfactory manner with the traditions and contemporary monuments of Egypt. He declares further that "the pivots of the history of Egypt, and perhaps of the whole world, are nothing less than these two points." The determination of these dates is reached by the most crucial scientific tests imaginable.

A still more remarkable event, the building of the great Pyramid, occurred, as is not disputed, during the reign of Cheöps of the 4th dynasty. In a former article we showed that it was impossible to have erected it only when its entrance passage pointed to the then North Star, either B. C. 3,440 when Alpha Draconi was moving towards the pole, or B. C. 2,170 when it was moving from it. We are aware that Richard A. Proctor has been endeavoring of late to show that the earliest date was the most probable one, and has quoted one ancient historian to

prove that this accords with history. But this date, that he quotes, was only conjecture and disagrees materially with his own estimate. How much more reasonable, if history be referred to, is the *generally accredited date* given in round numbers by Napoleon at the battle of the Pyramids, "*Soldiers, forty centuries look down upon you.*" And then again the later dates agrees to an inch with its own record, in another and entirely different manner, as we have before described. The preponderance of proof is largely in favor of the later dates, as we have heretofore shown. Proctor considers the entrance passage as built *solely* for astronomical purposes. But what astronomical purpose could be accomplished by building the stones in the entrance passage with joints perpendicular or erect, at the point, which, according to Prof. Smyth, corresponds with its erection B. C. 2,170. No ancient time-marks of the ages have been so distinctly and indelibly recorded as this date of the Great Pyramid, and apparently for a great purpose. Not till the fixed stars are hurled from their orbits, and God Almighty's great clock in the Heavens wears out or gets out of order, can these date-records be obliterated. They are where the conflagration of this globe can not destroy them.

Now here is a definite period of about 1,550 years for twenty-two dynasties, making an average of less than seventy-five years to a dynasty. We do not assume that Egyptian dynasties had any fixed common measure of duration. But we do say that where computation is based on mere hypothesis, some regard should be shown to the proved average of much the greater portion. If we prove that twenty-two out of twenty-six dynasties span over only about 1,550 years, on what reasonable ground can we base a supposition that the three preceding dynasties extended back to any very much more remote period? We have bridged over the dates between Jeremiah and Solomon by four dynasties, and covered without leaving a single chasm unspanned more than one and a half milleniums before Solomon, by eighteen dynasties, back to the fourth, leaving only three more before Pyramid times, to be accounted for by tradition, or based on hypothesis.

Even if we adopt the earlier date now advocated by Proctor, it makes no difference with regard to the time before Cheöps. For according to the most extravagant date-stretchers, Menes the first King of the first dynasty, lived only from 600 to 800 years before Pyramid times. And such historians as Diodorus (whom Proctor relies on for his early historical proof,) together with Herodotus, Eratosthanes and Manetho, all regarded Menes not only as the first mortal King of Egypt, but they were not backward in asserting their belief that he was identical with Misraim the grand-son of Noah.

Whoever can, let him give us a more rational and reliable history of Egyptian origin and dates from a monumental stand-point.

A BOSTON RAILWAY IN ASIA.

A company was organized in Boston, February 8, under a charter from Massachusetts, dated February 6, 1880, for the purpose of constructing and operating

a railroad from Cairo, Egypt, through Port Said and Damascus to connect with the Euphrates Valley Railway, about to be built by an English company. Branch roads and extensions are also provided for by the charter. The Turkish government has been applied to for a concession of the necessary right of way.

BOOK NOTICES.

THE YOUNGER EDDA. By Rasmus B. Anderson. Crown 8 vo., 302 pp. S. C. Griggs & Co, Chicago; 1880. $2.00.

The Older Edda was written in verse, and has been styled the mother of Scandinavian poetry. The Younger Edda is a collection, in prose, of the myths of the gods, and of explanations of the types and metres of the Pagan poetry of the Northland, and may be regarded as a completion of and commentary upon the Older. It is doubtless a compilation of the works of several authors, though commonly credited to Snorro Sturleson alone. The volume before us is a translation by Prof. Anderson, of the University of Wisconsin, and bears the marks of his almost unequaled knowledge of the Scandinavian languages, as well as of his exceeding fitness for the task of rendering into readable English this quaint compendium of Jewish, Christian, Greek, Pagan, Roman and Icelandic legends concerning the origin of the world, the history of the Scandinavian mythology, etc. It is more complete than any other English or German translation, and gives to the lover of antiquities the most complete and succinct idea of the ancient Teutonic faiths and beliefs, yet published. To such readers this work will have a powerful interest, while to nearly all, the explanatory introduction, copious notes and full index will render it interesting and attractive.

NOTES ON RAILROAD ACCIDENTS. By Charles Francis Adams, Jr. G. P. Putnam's Sons, New York. 12 mo., 280 pp. For sale by the Kansas City Book and News Company. $1.25.

While the bulk of this work is made up of accounts of various railroad disasters occurring within the past fifty years in this country and Europe, a good portion of it is devoted to bringing before the public in this practical and forcible way, the advantage of the Miller Platform and Buffer, the Westinghouse Brake, and the Interlocking and Electric Signal Systems.

Mr. Adams was, for ten years, one of the railroad commissioners of Massachusetts, and as such, necessarily became familiar with the causes and results of railroad accidents of most kinds, and naturally gave much attention to remedies and preventions. The work is written in narrative style and possesses far more attractions to the general reader than the subject would suggest.

It is probably the only compilation of the kind published, and, if for no oth-

er reason, it is interesting because it shows the vast improvements made within a few years, in the appliances adopted for the convenience, comfort and safety of travelers. Among the more interesting chapters may be instanced those upon Accidents and Conservatism, the Protection of Bridges, the Battle of the Brakes, and the Railroad Death-rate.

BRAIN-WORK AND OVER-WORK. By Dr. H. C. Wood. Philadelphia, Presley Blakiston, 1880 16 mo., 126 pp. 50 cents.

This is the tenth of the American Health Primers, and one of the best of the series. The author is Clinical Professor of Nervous Diseases in the University of Pennsylvania, and has probably had as much experience in such maladies as any physician of his age in the country. The subject, which is one of vital interest to Americans, is handled in a practical and familiar style, and the suggestions made are eminently u eful. Begining with statistics, the author shows that, while they may offer a solace to nervous people, from the fact that deaths from such diseases are not on the increase, the increasing wear and tear of modern life is showing itself in an increase of the diseases themselves. The work is divided into General Causes of Nervous Trouble, Effects of Emotional and Intellectual Work, Rest in Labor, Rest in Recreation, Rest in Sleep, with general conclusions remedial suggestions, which, if followed by the reader, may in many instances avert nervous prostration, softening of the brain, and other serious affections. These Health Primers are now published by Presley Blakiston, who has purchased the copyight and other interests from Messrs. Lindsay & Blakiston.

CIRCULARS OF INFORMATION OF THE BUREAU OF EDUCATION. By Hon. John Eaton, Commissioner. Washington, D. C., Government Printing Office, 1879. Nos. 1 to 5.

These circulars comprise about 240 pages, and consist of treatise upon Training Schools for Nurses; Papers, Addresses and Discussions at various Educational Associations and Conventions during the past two years; Report on the Value of Common School Education to Common Labor, by Dr. Edward Jarvis, of Dorchester, Mass.; illustrated by answers to inquiries, addresses to employers, workmen, and observers; Training Schools of Cookery; American Education, as described by the French Commissioner to the International Exhibition of 1876.

THE SCHOOL BULLETIN SERIES. Davis, Bardeen & Co., Syracuse, N. Y. 1880.

Among these we have received Half a Hundred Songs for the School Room and Home, by Hattie Sanford Russell, 35 cents; The Elements of Education, by Chas. J. Buell, a paper read before the Alumni of the State Normal and Training School at Cortland, N. Y., and so highly regarded by them that they requested its publication, 15 cents; Politics and Schools, an able defense of the Public School

as it is, in contra-distinction to the stereotyped addresses which commend only the Public School as it might be, by Prof. Sydney G. Cooke, School Commissioner, First District, Wayne Co., N. Y. All of these are valuable publications, especially to teachers and students who expect to teach.

WATER COLOR PAINTING. By Aaron Penley. New York, G. P. Putnam's Sons, 1879. Kansas City Book and News Company; 50c.

This is No. 5 of Putnam's Art Hand-Books, those previously published being Sketching from Nature, Landscape Painting in Oil Colors, Flower Painting, and Figure Drawing; all edited by Susan M. Carter, Superintendent of the Women's Art School, Cooper Union, New York. This series, reprinted from the most capable authors in England, and carefully edited by so competent and practical an expert, must really be what it purports to be, an excellent guide to the student and amateur in the various departments of fine art. The volume under consideration is a complete exposition of the present advanced state of water color painting, as exhibited in the works of the modern schools, and its careful study will enable the student who has the proper degree of taste, and the necessary patience to practice the rules laid down, to become a skillful artist. It is just such a hand-book as all such need lying on their tables for reference. The fact that the book is in its thirty-eighth edition is a guaranty that it has been and is still highly appreciated by artists and art students.

HOW TO LEARN SHORT-HAND. By Arthur M. Baker. S. R. Wells & Co., New York; 25c.

The demand for short-hand writers has, during the past few years, been rapidly increasing, and necessarily will continue to increase as the importance of all time-saving appliances in business matters is more generally recognized by business men. The telegraph and the telephone are largely depended upon by them; but, for some unexplained reason, very few have adopted stenography as an aid, though it would appear that they should be side by side in the counting-room.

This little work is arranged especially for the use of those desirous of acquiring the art without a teacher, and seems to offer the simplest, most practical and best adapted system for general purposes that has been proposed.

METAPHYSICS. A Lecture by Samuel Spahr Laws, LL.D. *Statesman* Print., Columbia, Missouri, 1879.

Dr. Laws is President of the Missouri State University, and Professor of Metaphysics, and this lecture is one of a course delivered during the session of 1878–9 by the Faculty. The object of the author is, first, to disabuse his audience of the impression that metaphysics is necessarily the abstruse and unintelligible subject that prejudice and ridicule have caused it to be regarded; and, next, to place be-

for them a clear and attractive history and explanation of what it really is—the Queen of the Sciences. In these points he has succeeded admirably, and the essay will be read with interest by all who undertake it unappalled by the title.

THE COTTON WORM. By Chas. V. Riley, M.A., Ph.D. Washington, D. C., Government Printing Office, 1879.

In this, as in almost everything he touches, Prof. Riley has given us an exhaustive account of the whole subject, including a summary of the natural history of the pest, an account of its enemies, and the best means of controlling it, with numerous illustrations in each of these branches of the subject. It would seem to be of immense advantage to the planters of the cotton States.

OTHER PUBLICATIONS RECEIVED.

Proceedings of the Poughkeepsie Society of Natural Science, October 1, 1878, to July 1, 1879.—No. 5 of the Publications of the Cincinnati Observatory, being a record of micrometrical measurements of 1,054 double stars, observed from July 1, 1878, to September 1, 1879, under the superintendence of Ormond Stone, A.M., Director.—Report on Magnetic Observations in Missouri during the Summer of 1879, by Francis E. Nipher, Professor of Physics in Washington University, St. Louis, Missouri.—Catalogue of Marietta College, Ohio, 1879–80.—Catalogue of Washington University, St. Louis, 1879–80.

EDITORIAL NOTES.

THE regular meeting of the Kansas City Academy of Science for February, was postponed on account of the lecture of Rev. S. B. Bell, on the same evening, he being a prominent member of the Academy, and many of the members desirous of hearing him.

THE lecture of Prof. F. E. Nipher, of Washington University, in the extra course of the Academy of Science, was delivered on the 17th of February. A full house was present and the lecture was received with every evidence of appreciative approbation. It will be published in full in the next issue of the REVIEW.

ON March 26th, Professor R. A. Proctor will deliver a lecture under the auspices of the Academy of Science, at the Opera House. Subject: "The Birth and Death of Worlds," one of the most brilliant and interesting of his series. The largest audiences ever congregated in New York, Boston and other large cities of this country, have listened to this lecture and gazed upon the splendid sciopticon illustrations with enthusiasm and profit. The people of Kansas City are to be congratulated upon having this opportunity offered them, as Prof. Proctor goes from here to the Pacific Coast.

DR. JOHN RAE writes as follows, from London, England: "I have read with interest and pleasure the paper, 'Peculiarities of

Missouri Ornithology,' in the January number of the KANSAS CITY REVIEW, in which I notice one little mistake. The 'Brant' is not the 'laughing goose,' but a different bird altogether; the former being much smaller than the latter. The peculiarity of the leading-goose or gander making a precipitate tumbling-down movement on deciding to alight, when flying at a great height, is not peculiar to the 'Brant.' I have seen the snow-geese, on their arrival from the North, or the shores of Hudson's Bay, do the same thing scores of times."

THE committee on the proposed monument to the memory of the late Prof. B. F. Mudge, have issued a circular in which they say:

"It is proposed to raise one thousand dollars for the erection of this monument, and the many friends of our beloved leader and associate are cordially invited to render all possible assistance. Local committees will be authorized to receive subscriptions in the chief towns of the State. Individuals not thus solicited are hereby invited to send their contributions to the Treasurer, Dr. R. J. Brown, Leavenworth, Kansas."

The people of Kansas City should subscribe at least one hundred dollars toward this fund. Photographs of Prof. Mudge been placed in the hands of Mr. T. S. Case, of this city, who will present one to each subscriber of one dollar towards this object.

THE *Daily New York Graphic*, in addition to the many features that have rendered it so popular among the best classes throughout the country, furnishes full financial and mining reports from all sections of the country.

PROF. MASKELYNE has decided that the diamonds, supposed to have been manufactured by Mr. McTear, are in reality only silicates. At the same time he publishes his belief that those manufactured by Mr. Hannay are genuine, and the only instances of artificially crystallized carbon ever brought to his notice. Prof. Roscoe, of Owens College, Manchester, says he regards the evidence thus far submitted by J. Ballantyne Hannay as insufficient to establish the conclusion. Dr. R. S. Marsden, of Sheffield, England, by a different process from any thing known heretofore, has also obtained a crystalline body, believed to be crystallized carbon, or diamond.

ACCORDING to a *Boston Journal of Commerce* correspondent, the Lowe water-gas is a perfect success, and can be furnished ready for use, including fixtures for lighting, heating and cooking, at an expense to the consumer, of not over fifteen cents per thousand feet and at the same time give the manufacturers a profit of three hundred per cent.

A FRIEND sends the following extract from a recent letter from Capt. Kennedy, of St. Andrews, Manitoba: "I have again very cordially to thank you for now a third number of that exceedingly well gotten up, and very interesting publication, THE KANSAS CITY REVIEW. When I met my old friend, J. N. McTavish, of the Hudson's Bay Company, the other day, his first remark was, 'Have you seen the KANSAS CITY REVIEW? I never thought they could have gotten up so able a paper way down in Missouri!'"

THE *Atlantic Monthly* has always numbered the ablest and best American writers among its contributors. The April number will give the first chapters of Mr. Aldrich's new story. It will also contain short stories by Mrs. Rose Terry Cooke and Mr. W. H. Bishop; and the fourth installment of Mr. Howell's serial. Among its literary attractions will be a paper on "A Woman of Genius," by Miss H. W. Preston; and a study of Coleridge, by Mr. G. P. Lathrop; there will be a very valuable and interesting article giving reminiscenses and and couversations of the late Wm. M. Hunt; and the third number of Reminiscences of Washington. It is hoped that a paper by the author of "Certain Dangerous Tendencies in American Life," equal to that remarkable article in value and interest, will appear in the same issue.

THE Topeka Scientific and Literary Club was organized about one year ago, by a num-

ber of gentlemen and ladies of scientific and literary tastes, for the purpose of mutual improvement, profit and pleasure. The membership of the club consists of four classes—Active, Associate, Honorary, and Corresponding. Active members are subject to detail for the preparation and presentation of papers, which are subject to discussion by the Club. Associate members are entitled to vote and to participate in discussions, but are not subject to detail for the preparation of papers. Honorary and Corresponding members are assigned the functions usually possessed by members of that class. For the present year the officers are as follows: President, Prof. John T. Lovewell; Vice-President, Miss Eunice A. Lyman; Secretary, Geo. S. Chase; Treasurer, J. Lee Knight.

EDISON feels so sanguine of the success of his electric light, that he has already taken steps toward establishing central stations in New York City, and has perfected his plans for districting the city, each district containing from twenty-five to thirty stations. Each station will be supplied with five Holly engines of from 250 to 300 horse power. Four of these engines will be in constant use, the fifth to be reserved for use in the event of an accident or any of the others. Each station will occupy a space of 50 x 100 feet. He claims that he can stand by the switchboard in his laboratory and extinguish any or all of the lights in the park or in the houses illuminated from his laboratory, and that in less than a year he will have the electric light in successful operation in New York.

THE subject of Arctic Exploration is agitating scientific circles considerably just at the present, and the colonization scheme of Captain Howgate seems to be favored by nearly, if not quite all practical men. We notice an account of an interview of Dr. Octave Pavy by a *Globe-Democrat* reporter, in which that explorer and writer speaks of it as "an admirable plan, and one that must succeed." Captain Silas Bent, of St. Louis, also speaks highly of it, while of Eastern scientists, Dr. Hayes, Profs. Henry, Loomis, and Silliman have all endorsed it in strong terms.

It will be seen from an article in this number of the REVIEW, that Captain Howgate has offered to the government, free of charge for use, or liability in case of loss or damage, his steamer, the Gulnare, for a trip to the polar regions, thus "proving his faith by his works" in the most satisfactory manner.

AN arrangement has been entered into between the English Post-office and Bell's Telephone Company, by which the Postmaster-General undertakes to give every facility for the extension of telephone communications. The Telephone Company will pay a royalty to the Post-office, and may use the post-offices and staffs under certain conditions for their work. Thus telephone wires may be run from a post-office to the town offices or country residences of gentlemen, and telegrams arriving at post-offices for them may immediately be communicated by telephone, thus saving time.

THE Silverton, Col., *La Plata Miner*, of February 14th, says: "The continued fall of snow is discouraging. Mining operations are hindered, travel is impeded, and mails are delayed, business interupted and pleasure thwarted. The snow is from four to eight feet deep on a level, and in some places where it has drifted, one would have to sink a prospecting shaft to find out its depth. Still we anticipate an early spring and a big rush to this camp. Indications point to the fact that the coming season will be one of the most prosperous ever enjoyed by the San Juan country."

AT the London Physical Society, January 24th, Herr Faber exhibited his new speaking machine, which imitates the human voice by means of artificial vocal organs of wood and rubber operated by keys like a piano. Fourteen distinct vocal sounds can be uttered by this instrument, and by combining these, every word in any language can be produced in higher or lower tones, as well as the sounds of laughing and whispering.

A RECENT visit to the Kansas University gave us additional reason to believe that it is one of the best managed, and most completely equipped institutions in the country and that its professors are able, zealous and competent gentlemen, while its students are unusually enthusiastic and ardent in their devotion to the branches of education in which they are respectively engaged.

THE proposition of Mr. Eads, to construct a ship railway across the American Isthmus, is now before Congress in the form of a bill authorizing him and his associates to organize a company for the purpose of securing the necessary concession from one of the Central American States, and to locate and construct the necessary works.

We hope that Mr. Eads will obtain the careful and liberal consideration of Congress. He has given such evidence of ability, courage and indomitable energy in great engineering works during the last twenty years, in the construction of the gun-boats, the St. Louis bridge, and the jetties at the mouth of the Mississippi River, that the country will feel assured that the solution of this difficult and deeply interesting question is near at hand if it be intrusted to him.

BY a decree of December 14, 1874, His Majesty the King of the Belgians offered an annual prize of twenty-five thousand francs for the encouragement of intellectual effort. The prize for the year 1881, for which authors of all nations may compete, will be awarded to "The best work on the means of improving ports established on low and sandy coasts like those of Belgium." Foreigners desiring to compete for this prize will be required to send their works, either printed or in manuscript, to the Minister of the Interior, at Brussels, before the 1st day of January, 1881.

WE notice that, at the State Convention soon to be held in the interest of Immigration, among other distinguished writers and essayists, "Geo. M. Shelley, mayor of Kansas City, is to furnish an article upon Kansas City, its Wealth and Industries: its Progress and Prospects."

THE *Engineering and Mining Journal*, with which have been incorporated the *Coal and Iron Record*, the *Mining Review*, and the *Polytechnic Review*, continues to be, as we have heretofore stated, a most reliable record of progress in metallurgy, engineering, mining and general science. Its editors are practical experts in their respective departments, and endeavor to give strictly accurate and just accounts of what is going on in the country. We are led to make these comments just at this time because our friend Professor C. E. Robins, late of Summit, Colorado, an experienced mining engineer, has recently been added to its staff, which must necessarily increase its popularity wherever he is known.

THE *Popular Science Monthly* for March is rich in the variety of its contributions, but is especially strong in the direction of education. In this field it is doing a most important public work, its educational papers being abler and more advanced in their treatment of principles than those contained in journals professedly devoted to the subject. The contents for March are: The Association of Ideas (illustrated), by William James, M.D.; Dolmens in Japan (illustrated), by Professor Edward S. Morse; The Study of Political Economy, by Henry George; Ward's Na ral Science Establishment, by Professor Jos Leidy; The Force Behind Nature, by W. iam B. Carpenter, F.R.S.; New Views of A. imal Transformations (illustrated), by Edmond Perrier; The Duty of Enjoyment; Intemperance in Study, by D. Hack Tuke, F.R.C.P.; Water as Fuel, by William C. Conant; The Early Free Schools of America, by Alice H. Rhine; Prehistoric Ruins in Southern Colorado, by Henry Gannett; The Convent of the Capuchins, by Arthur Searle; Athletics in Schools; The Matamata (illustrated), by E. Sauvage; Frost Phenomena in Southern Russia; Sketch of Carl Ritter (with portrait); Correspondence, Editor's Table, Literary Notices, Popular Miscellany, and Notes.

THE *North American Review* for March can not fail to be of unusual value and interest to all who desire clearly to understand all the present important phases of American politics, as is evidenced by the following table of contents: The Third Term—Reasons against it, by Judge J. S. Black; The Third Term—Reasons for it, by E. W. Stoughton; The Communism of a Discriminating Income Tax, by David A. Wells; Civil-Service Reform, by Henry W. Bellows, D.D.; Our Political Dangers, by Professor Simon Newcomb; Mr. Froude's Historical Method, by the Right Rev. J. L. Spalding, D.D., Bishop of Peoria. Recent Biography—I. Life and Works of Gilbert Stuart; II. The Letters of Charles Dickens; III. Memoirs of Madame de Rémusat—by Eugene L. Didier.

THE December number began the sixtieth volume of *Harper's Magazine*. The serial novels—White Wings, by William Black, and Mary Anerley, by R. D. Blackmore—are continued. The April number will contain the first of two papers on Music and Musicians in England, by Mrs. John Lillie, illustrated with portraits, and with drawings by Abbey, to which is added an engraving from L. Alma Tadema's portrait of Georg Henschel; Some Pennsylvania Nooks (including the neigborhood of Valley Forge), by Mrs. Ella Rodman Church, with illustrations by Pyle; La Villa Real de Santa Fe, by Ernest Inger- , with illustrations by Harrison Mills; An sh Fishing Village, written and illustrated by J. L. Cloud; Luca della Robbia and his School, by E. D. R. Bianciardi, beautifully illustrated; The Swiss Rhine, by S. H. M. Byers, with illustrations; Home Studies of Nature, by Mary Treat, with illustrations by J. C. Beard; History of Bible Illustration, by William C. Prime (illustrated); a thrilling poem, entitled Shipwrecked, translated from the French by E. W. Latimer, with two illustrations by Reinhart; a valuable and suggestive paper, by E. H. Derby, on The Navy of the United States; short stories by Phœbe Yates Pember and Virginia W. Johnson; and other interesting matter.

NEW PERIODICALS RECEIVED.

THE *Practical American*, an independent monthly, devoted to manufacturing and building, P. H. Vander Weyde, M.D., editor and proprietor; $1.50 per annum.

The Liberal, a handsome new monthly literary paper, published at Leavenworth, Kansas; $1 per annum.

The *Naturalist's Quarterly*, Salem, Massachusetts; 55c per annum.

The *Journal of Science*, Toledo, Ohio, Vol. III. No. 1, monthly; $1 per annum.

Science Advocate, Atco, New Jersey, quarterly; 15c.

American Monthly Microscopical Journal, Romyn Hitchcock, F.R M.S.; $1.

The San Juan Expositor, Prof. Theo. B. Comstock; monthly; $1.

The American Entomologist, monthly, Prof. Chas. V. Riley and A. S. Fuller; $2.

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KANSAS CITY

REVIEW OF SCIENCE AND INDUSTRY,

A MONTHLY RECORD OF PROGRESS IN

SCIENCE, MECHANIC ARTS AND LITERATURE.

VOL. III. APRIL, 1880. NO. 12.

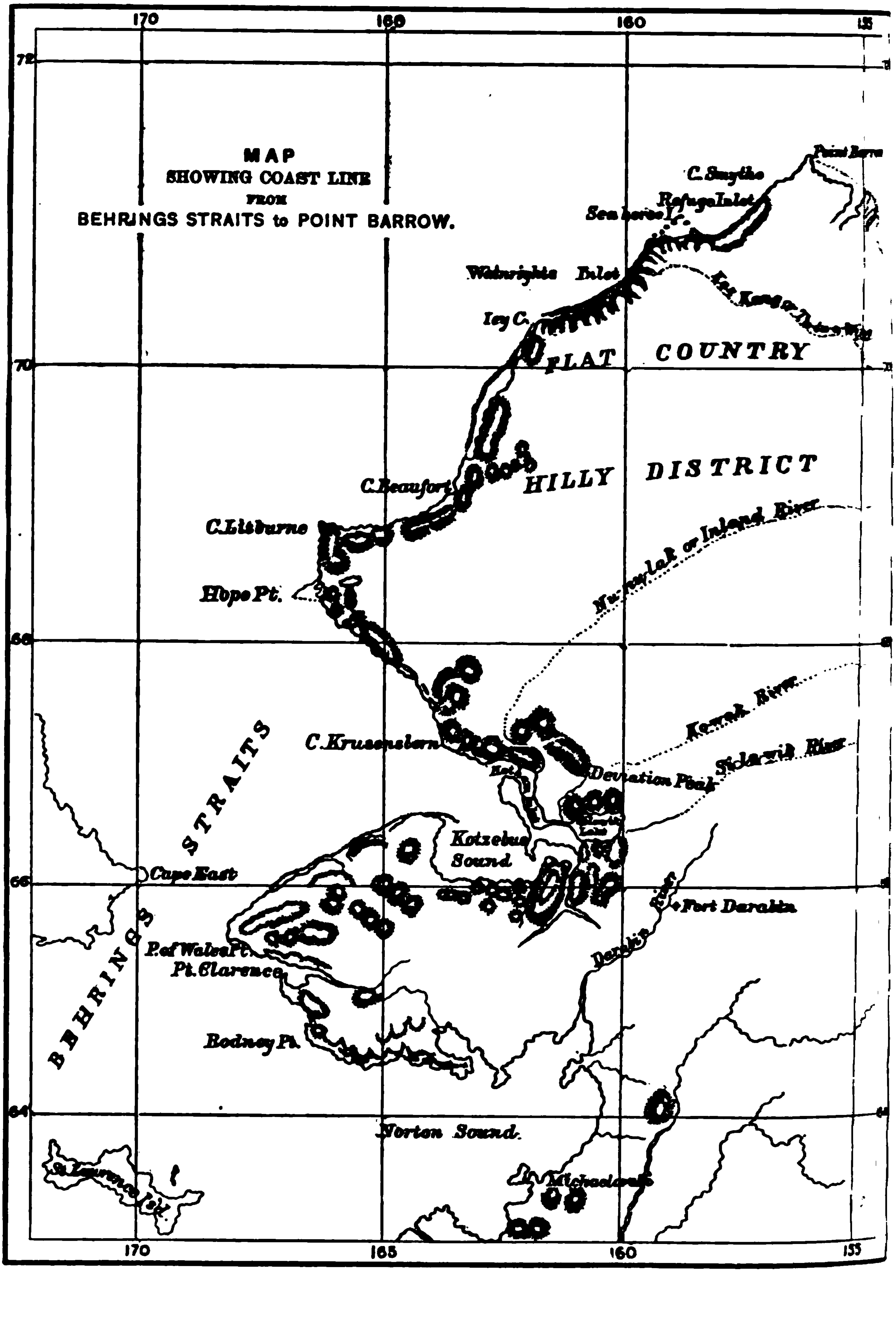
GEOGRAPHICAL NOTES.

NOTES ON POINT BARROW.

The following notes on Point Barrow, collected from various reliable sources, will be of interest, in view of the fact that it has been selected as one of the international stations for scientific observations, recommended by the recent Geographical Congress at Hamburg, and will probably be occupied by the United States at an early date: [ED.

Point Barrow is the northern extremity of the western portion of the American Continent, and consists of a low spit of sand and gravel projecting to the northeast. Its length is about four miles, and it is a little more than a quarter of a quarter of a mile in average breadth, but expands considerably at its extremity, where it rises to about sixteen feet in height and sends out to the east-southeast a low narrow ridge of gravel to a distance of more than two miles, succeeded in the same direction by a row of sandy islets inclosing a shallow bay of considerable extent. The assemblage of the winter huts of the natives is placed on the expanded and more elevated extremity where there is a thin layer of grassy turf. The number of inhabited huts in the winters of 1852–53 was fifty-four, reduced to forty-eight in the succeeding year, in consequence of the scarcity of oil to supply so many fires. Besides these, there were a few vacant huts and two dance-houses. The total population at the end of 1853 was 309, of whom 166 were males, and 143 females.

The sea in the vicinity affords several varieties of whale, the walrus, four different sorts of seal, the polar bear and some small fish. The inlets and rivers yield salmon, herring and the smelt, besides other kinds of large and small fish; and on


MAP
SHOWING COAST LINE
FROM
BEHRINGS STRAITS to POINT BARROW.
170
165
160
155
72
70
68
66
64
Point Barrow
C. Smythe
Refuge Inlet
Wainwrights Inlet
Icy C.
FLAT COUNTRY
HILLY DISTRICT
C. Beaufort
C. Lisburne
Hope Pt.
C. Krusenstern
BEHRINGS STRAITS
Cape East
Kotzebue Sound
Deviation Peak
Kowak River
Fort Darabin
Pt. Clarence
Rodney Pt.
Norton Sound.
St. Lawrence Isl.

the land, besides an abundance of berries and a few edible roots, are obtained the reindeer, the inma (an animal which nearly answers to the description of the Siberian sheep), the brown or black bear, a few wolverenes and martens, the wolf, the lynx, blue and black foxes, the beaver, musk-rats and lemmings. In summer, birds are very numerous, particularly, geese in the interior, and ducks on the coast. The ptarmigan and raven remain throughout the winter, and the latter is the only living thing known to be rejected as food.

The articles in common use, for which the natives are indebted to strangers, are kettles, knives, tobacco, beads and tin for pipes. The tobacco bag is the constant companion of men, women and even children.

The winter huts at Point Barrow, form a scattered and confused group of grassy mounds, each of which generally covers two separate dwellings with separate entrances. The entrance to each hut is from the south, by a square opening at one end of the roof of a passage twenty-five feet long, and has a slab of ice, or other substance of convenient shape, to close it at pleasure. The passage, which is at first six feet high, descends gradually until about five feet below the surface of the ground, becoming low and narrow before it terminates beneath the floor of the hut The dwelling place is entered by a round aperture in the floor, on the side nearest this passage, and is a single chamber of square form, ranging in size from 12 to 14 feet from north to south, to 8 to 10, from east to west. The walls are of stout planks. The general form and arrangement will be understood by reference to the illustrations herewith.

The natives at Point Barrow divide the year into four seasons. The opening of winter is taken as the beginning of the year. During the winter the sun is not visible for about seventy days

The following notes show that it is comparatively easy for a properly equipped vessel to reach Point Barrow during any ordinary season:

The "Blossom" left the harbor of St. Peter and St. Paul on July 5th, 1826. On the 18th, when off St. Lawrence Island, a current was found to be setting to the northeast, three-quarters of a mile per hour. On the 20th the Diomede Isles were reached and Kotzebue Sound on the 22d. Leaving that place on the 30th, the current off Port Hope was found to be superficial, that is, not extending twelve feet below the surface, but, at the surface it attained a rate, in the westerly direction, of three miles per hour. In the evening it slacked to one and one-half miles. On the 8th of August Cape Lisburne was reached and the edge of the pack was fallen in with, in latitude 71°, 8′ north, on the 13th. The barge, under the charge of Mr. Elson, was sent to the northward on the 17th, and the "Blossom" returned to Kotzebue Sound on the 28th. The barge arrived here on the 10th of September, having reached Point Barrow in 71° 23′ 30″. In returning, she was driven on shore by the pack; but, the wind coming round to the south-southeast, she made her escape with much difficulty. The ice at Point Barrow was aground in four fathoms water, and was fourteen feet above the level of the sea. On the 13th of October the thermometer fell to 27° and the edge of the

Ground Plan of Esquimaux Hut.

A [illegible]
B Entrance hole in the floor.
C Central space for cooking fire.
D Underground passage.
E Family sleeping-places.
F [illegible]
G Logs to rest the head on during sleep.
H Walls of thick boards.
I Earth embankment.

Interior of Esquimaux Winter Hut.

sound began to freeze. The "Blossom" proceeded to sea and reached the Aleutian Islands on the 22d of October.

Captain Beechey remarks, "that off Icy Cape the current appeared to be influenced by the winds. Near Point Barrow it ran at the rate of three miles per hour and upward to the northeast, and did not subside immediately with the wind; but, the current here must have been accelerated by the pack closing in on the beach."

Her Majesty's ship, "Herald," Captain Kellett, arrived at Petropaulski on August 14th, and at Kotzebue Sound on the 1st of September, where she remained until the 29th. The "Plover," Commander Moore, left Honolulu on August 25th, reached the Island of St. Lawrence on October 13th, went into harbor near Tchutski Ness, in latitude 64° 20′, and longitude 173° 15′ west, on the 25th, and was permanently frozen in on November 18th. On June 13th, a clear lane of water enabled the ship to put to sea, and she arrived at Chamisso Island, Kotzebue Sound, on July 14th. The "Herald" joined the "Plover" in Kotzebue Sound on July 15th, and in company with the "Nancy Dawson," (Captain Sheddin's yacht) proceeded to sea on the 18th. On arriving at Wainwright Inlet the boats were dispatched from the ships on the 25th instant, and Lieutenant Pullen, in command of them, reached Point Barrow on August 4th, in company with the "Nancy Dawson." After seeing the boats fairly off on their route to the Mackenzie River, Mr. Shedden rejoined the "Herald" in Kotzebue Sound. The "Plover" passed the winter of 1849–50 in Kotzebue Sound and left on July 17th, and proceeded to the northward, leaving the ship off Wainwright Inlet on the 23d, in two boats. Captain Moon reached Point Barrow on the 27th, and went round it as far as Dease Inlet, and returned to Grantley Harbor, Port Clarence, on the 30th, where he passed the third winter. The "Investigator" left Oahu on July 4th, passed through the Aleutian chain of Islands on the 20th, and reached Cape Lisburne on the 29th. Entered the ice in latitude 72° 1′, north and longitude 155° 12′, west, and at midnight on August 5th, rounded Point Barrow in seventy-three fathoms water, ten miles from land. They got into open water on the American shore on the 7th and landed at Port Drew on the 8th.

The "Enterprise" left the Sandwich Islands June 30th, and passed through the Aleutian chain of Islands on July 28th. East Cape was reached on August 12th. The total set of the currents in the intervening days being north, 49° east, 127 miles. Passing Point Hope, Cape Lisburne and Wainrwight Inlet without seeing anything of the "Herald," "Investigator," or "Plover," the "Enterprise" got up to the ice on the 16th, and pushing through some brash ice, entered an open lane trending northeast and southwest, ten miles wide, up which she proceeded until she had gained a position northeast by north, 100 miles from Point Barrow and had forty-five fathom's depth of water-mud. Here her progress was barred, and after searching in vain for any opening on the southern side, she was, on the 21st, within thirty miles of the land without a prospect of making it. The ice hummocks here were frequently found to be twenty-five feet above the sea, and

in one or two instances, as much as thirty feet was seen; but this was the greatest height. Here no bottom with sixty fathoms was found, and the temperature of the sea rose to 40°. Seeing there was no hope of progress in this lane, the ship's head was turned to the southward, having traced the pack in a southeasterly direction for 145 miles from latitude 72°, 45′, and longitude 159°, 5′, west, with no signs of opening to east or southeast. Further progress to the eastward was considered impracticable this season.

. The "Amphitrite," Captain Frederick, with Commander Maguire and a fresh crew for the "Plover," arrived at Port Clarence on the 30th of June. Leaving on the 12th, Commander Maguire proceeded to the north, and went up to Point Barrow in the boats, where a rapid survey of the harbor was made and sufficient depth of water for the "Plover" was found, he returned to that vessel, and succeeded in placing her in winter-quarters at Point Barrow, on the 21st of August, and was frozen in on the 24th of September. Before being frozen in he succeeded, in his boats, in reaching the coast to the eastward as far as the Return Reef of Franklin. The "Plover" did not get clear of her winter-quarters at Point Barrow until the 7th of August and on the 11th of the same month fell in with the "Amphitrite," Captain Frederick, and after replenishing her provisions returned to Point Barrow on September 7th. In attempting to prosecute the search easterly, an armed body of Indians of the Kokukun tribe was met with, and found so hostile that he was compelled to return; otherwise he would in all probability, have reached the "Enterprise," which vessel was stopped by the ice in Camden Bay, about eighty miles from the farthest point reached by him.

The "Plover" cleared her winter quarters on July 19th and, having received fresh supplies from Her Majesty's ship "Trincomaler," returned to Point Barrow on August 28th, being in no way impeded by the ice. The same evening the "Enterprise" arrived from the southward. This latter vessel had wintered in latitude 70° 8′, longitude 145° 29′, west; 245 miles to the eastward of Point Barrow, where she was beset on September 16th and frozen in on the 26th, in the pack in Camden Bay, four miles from shore. On the 10th of July, the whale-boat of the "Enterprise," under the command of Lieutenant Jago, was despatched from her to Point Barrow, at which point she arrived on the 24th. The ice broke up sufficiently to admit of the ship being moved on the 15th, and she reached Point Barrow on the 8th of August, Point Hope on the 10th; but owing to the prevalence of southerly winds and a strong northerly current, did not arrive at Port Clarence until the evening of the 21st, when they communicated with the "Rattlesnake," and found that the "Plover" had sailed for Point Barrow two days previously. The "Enterprise" left for Point Barrow on the afternoon of the 22d. On the 28th, they made the ice in latitude 70.0°, and longitude 159.0°, west, and reached Point Barrow the same afternoon, and, after communicating with the "Plover," returned to Port Clarence on September 8th, the "Plover" arriving the following day. Both vessels left for the south on the 16th.

"Through the large opening between the American and Asiatic continents,

occupied by the Aleutian Islands, there is an almost imperceptible set from the Pacific Ocean northward, the waters of which, retaining the impulse given them by the earth's rotation in a lower latitude, draw toward the American shores, and throw themselves into Norton Bay. They are thence driven with increasing force along the coast of America opposite the Island of St. Lawrence, diffusing themselves to the north of that island, to be carried, with lessened speed, through the Straits of Behring, after receiving, in the latter part of their course, the fresh-water stream falling through Grantley Harbor into Port Clarence. Spreading again over a larger space, they receive a further tribute from Kotzebue Sound, which is very palpable, off Port Hope. Again, in the latitude of Icy Cape, the earth's rotation gives them an easterly set, forming an almost constant current along the northern coast of America to Point Barrow, whence it pursues a direction northeast. Throughout all this course the current is subject to retardations, and even surface-drifts in an opposite direction, caused by northerly and northeasterly winds; but it is also accelerated by southerly and southwesterly gales.

From recorded observations, it appears that the coast, from Icy Cape to Point Barrow, is frequently packed with ice in the end of July and the beginning of August. The cause of this seems to be the occasional prevalence of westerly and northwesterly winds, which drive the pack upon the coast, again to be cleared away by the northeast current along shore, as soon as these winds have spent their force; and southerly and southeasterly winds will have the opposite effect of driving it in a more northerly direction, and leaving the navigation more open than usual. At Icy Cape, the current on Captain Beechey's chart is marked as running both ways along shore, but not, it is presumed, with the regularity of a regular tidal ebb and flow. During the continuance of an easterly gale, from the 29th of July to the 5th of August, and a fresh breeze following for two days at that cape, floating substances were observed to drift slowly to leeward, while the waves were short, irregular and much more broken than usual, to a distance of twelve miles off, as if caused by a weather current. This may, however, be partly owing to the shoals extending four miles off the land. On the 23d, a whaling vessel stood within six miles of the shore, tacked and stood out again, making such progress to windward as a sailing vessel could only do when favored by a strong weather current.

From Icy Cape to the Seahorse Islands, in addition to drift-wood, there is strewn along the beach a quantity of coal, which, though much water-worn, may, in some of the indentations, be collected in sufficient abundance and bituminous enough to make an excellent fire for cooking. It is of the sort called candle coal, and some of the pieces are sound enough to be carved by the natives into lip ornaments. At the Seahorse Islands it is found as fine as small gravel, and, on digging into the beach, it is seen to form alternate layers with the sand; but, between Wainwright Inlet and Icy Cape, it is gathered in knots of a convenient size for fuel. This may be taken as a farther evidence of the set of the current, as the nearest known point whence the coal is brought is that marked on the chart Cape Beaufort.

The whole extent of the coast from below Icy Cape to Point Barrow is bordered by a beach of gravel, which has likewise a southern origin, and determines the form of the continent, offering, as it does, an effective barrier to the encroachment of the sea, which would otherwise speedily undermine the earth cliffs behind. All that can be seen from the seaboard landward is a flat, alluvial plain, seldom exceeding twenty feet in elevation, and containing numerous lagoons of fresh water, but without a tree or bush to relieve the view."

It will be seen from the foregoing abstracts that the navigation of the Arctic Sea, between Behring Straits and Point Barrow, is comparatively easy to vessels fitted for ice navigation. The current of warm water from the Pacific sets continually to the northeast throughout the summer months, and forms a lane between the pack and the land, which enabled the Blossom's barge, on August 21, 1826, to reach Point Barrow.

Thos. Shedden, in a schooner yacht of 140 tons, rounded the Point on August 4, 1849.

The Investigator, Commodore McClun, on August 5, 1850.

The Enterprise, Captain Collinson, on August 20, 1850.

The Enterprise, Captain Collinson, on July 25, 1851.

The Plover, Commodore Maguire, and wintered there, being frozen in September 24, 1852. The Plover left her winter quarters August 7, 1853; returned to her winter quarters, September 7, 1853; again left her winter quarters, July 19, 1854; returned to her winter quarters, August 28, 1854.

The Enterprise, returning from the eastward, rounded the Point August 8, 1854; and returned from Port Clarence, August 28, 1854.

The season of 1854 was undoubtedly the most open, the ice being so far from the Point that the whaling ships were enabled to fish off it.

The season may be considered to be open from the beginning of July to the middle of September. The pack is usually met with off Icy Cape, and, should westerly winds have prevailed, and forced the pack into the shore, a vessel will do well to wait until the wind subsides, when the current will be sure to open the lane between the land and the pack. Easterly winds check the current, and, after a continuation of them, there is a set along shore to the southward. Some natives got adrift on the ice, in 1853, and were carried by this set to the southward of Icy Cape, the land being always in sight.

In both years in which the Plover wintered at Point Barrow, the ice around the Point was broken up and swept to the northward by southwesterly gales. At times no ice could be seen from the masthead. In 1853, this disruption occurred in December, and caused the water to rise 3½ feet above the highest spring tide. The temperature at the same arose to 30° F. In January, 1854, the same thing occurred, the thermometer on this occasion rising to 27°. During both winters a water sky to the northwest was generally observed from the ship, unless after a long continuance of northwesterly winds or calm weather. There is but little rise and fall of the tide, 0.7 inches being the average. With fine weather or easterly winds,

they are very regular, but southwest gales upset them altogether.

Esquimau whale fishing commenced on May 7, 1853, the open water being four miles from Point Barrow, extending in an east-northeast and west-southwest direction, with a depth of ten fathoms water.

Between the 4th and 7th of July, about thirty "oomiaks," carrying about 150 people, went to the eastward. The ship swung to her anchor on July 25, and the ice was in motion in the offing on July 30.

The Plover's log shows that, in 1852–3, open water was seen on twenty-seven days, between October and April, and in 1853–4, on seven days only, while the indications of open water occurred during the same period in 1852–3 on fifty-seven days, and in 1853-4 on sixty two days. December, January and February appear to be the months during which the ice is more frequently in motion.

It is remarkable that, though the winter of 1852–3 was warmer than the ensuing one, the Plover was detained by the ice in her winter quarters until August 7, whereas in 1854 she made her escape to the southward on July 23, and the ice during the summer was so far off the Point that the whale ships fished off it.

On July 10, the water along the coast was sufficiently open to send the whale boat to Point Barrow. On the 15th the ice broke up, which was three days earlier than at Point Barrow. The ship left Camden Bay on the 20th, but, owing to obstruction by the ice, did not reach the Point until the afternoon of August 7.

In 1821, Point Barrow was reached, in the month of July, by Captain (afterward Sir John) Franklin, during his first overland journey to the shores of the Polar Sea.

In 1837, Messrs. Dease and Simpson made a boat journey from the Mackenzie River to Point Barrow. Leaving Fort Chipewyan on June 1, they reached Point Barrow on the 4th of August, and returning arrived at Fort Good Hope August 28.

INTERESTING DISCOVERY IN GREENLAND.

Mr. Komerup, who accompanied Lieutenants Jensen and Hemmer in their scientific investigations, as Geologist, reports having met an extraordinary and at present unexplained phenomenon.

He states that, in the course of his explorations in the ice-fields of the interior, he ascended a hill, the top of which was covered with flowers and vegetation. Several kinds of small animals were also found there. His detailed report will be looked for with interest.

RUSSIAN GEOGRAPHICAL SOCIETY.

The annual re-union of this body took place January 23 to February 4. The session opened with an account of the labors of the Society for the year 1879, from

which it appears that it has been especially active in scientific enterprises, extending throughout most of the empire. The Society lost during the year several of its most active members, notable among whom are named: Mgr. Innocent, one of the Society; Prince Bariabusky, and Professor Brandt.

In distributing the annual medals, it was found that there was no one entitled to the Grand Constantine Medal, which should have been awarded to the best work on Statistics. The medal of Count Lutke, was awarded to M. Inostrantrew. Gold medals were given to MM. Zolotwitsky and Orlow, for their works on Ethnology.

GEOGRAPHICAL SOCIETY OF FRANCE.

The membership of this society, on the 31st of December, was reported by its secretary as numbering 1,915, while in 1864 the number of members was only 303.

The Society includes among its members the rulers of nine countries, the most active of whom is Dom Pedro of Brazil.

METEOROLOGY.

COMPLETENESS AND VALUE OF INTERNATIONAL WEATHER REPORTS AND WEATHER CHARTS.*

Many years ago, the elder Herschel said: "In endeavoring to interpret the weather, we are in the position of a man who hears at intervals a few fragments of a long history, related in a prosy, unmethodical manner, while a host of circumstances omitted and a want of connection between the parts prevent the hearer from obtaining possession of the entire story." The old astronomer, accustomed to the exact methods and the multiplied observations in which his own science reveled, could ill brook the guess-work, or patiently decipher the vague and scattered material of the meteorology of his day. To supply the lack of which he complained—to furnish the missing fragments of this aërial history, to bring in the omitted circumstances and connect them in one harmonious whole—is the object of the International Weather Service, as originated, organized and operated in the United States.

It is our present purpose to describe or review this vast, novel system of *international* research, which, in very recent years, springing up almost silently into vigorous existence, enlisting the coöperation of numerous governments and

* We call the particular attention of our readers to this article, as being the most comprehensive and complete history and exposition of the workings and advantages to the commerce of the world, of the International system of weather reports, yet published in any magazine of this country or Europe.—[Ed.

many public and private laborers, both on the land and the sea, has already stretched its network of observers over the larger habitable part of the Northern Hemisphere, and aims at nothing less than to put the atmosphere in every attainable quarter of the globe under tribute. A system of such comprehensive and ambitious scope might well stagger the mind, and its very proposal raise many questions of feasibility hard to answer, did we not remember that the atmospheric ocean is a unit whose parts and elements, "distinct as the billows, yet one as the sea," wayward and lawless in their motions as they may appear, are, nevertheless, so nicely adjusted as to form an *orderly structure*—a beautiful and mighty mechanism; working, however inscrutably, obedient to laws impressed upon it by the Hand from which it originally came—exposed everywhere to man's inspection, and announcing to him both the play of its ponderous machinery and its subtler processes, by sounds and signals familiar to all. While the most visionary zealot of science could not dare hope ever to perfect such a research, the humble laborer may hope to gather much from its patient pursuit. For it does not seem incredible that, with a system whose chains of observations cover so expansive a field, many discoveries may be made, which ages of circumscribed investigation could never promise. If the ripple made on the placid bosom of the lake extends its circle of disturbance from shore to shore, the storm makes itself widely felt and rests not until it has agitated the whole aërial sea. That sea has its flood and ebb tides, its system of circulation—horizontal and vertical, and its normal exchanges of heat and cold, not less than the Atlantic and Pacific Oceans have their currents and their counter-currents moving within given limits and maintaining a substantial equilibrium. If, then, the Atmosphere, over large portions of the globe, can be *simultaneously* observed, and its phenomena represented to the eye in *graphic* forms or diagrams, so that the student can get clear ideas of its movements and changes, and trace them to their origin and end, as well as leisurely examine the seemingly eccentric, but orderly, manœuvres of its great forces, executed on the surface of the earth regardless of local or national boundaries, the chief difficulty of the meteorologist is removed; the fog, which for centuries has overhung his science, lifts, and he enters upon a new, auspicious era of research, pregnant with promise. The ripened results of such a work may aspire to rank with other scientific finalities.

But the first fruit it has yielded can now be seen in the daily publications of international meteorology at Washington—chiefly in the beautiful, colored International Weather Chart for the Northern Hemisphere. This chart, it is true, is only a weapon of research—an *instrument* to facilitate investigation; but, as we shall presently see, it is a powerful instrument—as the telescope to the astronomer. If the great English poet could represent Galileo, "the Tuscan artist," with his rude "optic glass"—its polished face mirroring the moon—as full-armed,

> "At evening, from the top of Fesolé,
> Or in Valdarno, to descry new lands,"—

we may not inaptly view the modern investigator, having this *Chart*, on which the atmospheric movements and mechanism are cast and depicted—as equally

well-armed for descrying these majestic operations and benign arrangements of the aerial world, which must awaken in every true mind unutterable admiration of their Author, Who "cômmandeth and raiseth the stormy wind," even as of old, when tossed on the waves of Gennesareth, in omnipotent tones, He bade it "Be still!"

The immediate official origination and organization of this new system of international simultaneous observations are due to the skill and earnest labors of General Albert J. Myer, the Chief Signal Officer of the Army. In 1872, when the present Weather Bureau under his direction was struggling into existence and effectiveness, that officer had extended the system of observations beyond the confines of the United States, by inviting "all ship-owners and those interested in commerce" and all "ship-captains and others making voyages to sea to make the necessary observations at the stated times,"* furnishing blanks to such as were willing to accept the invitation, as a number did. The object of this effort was to bring the largest portion of the atmosphere possible under simultaneous research; but this required greater coöperation and concentration than any one nation could effect. Accordingly, early in the following year, General Myer exerted himself to prepare a scheme for concerted international meteorology and to secure the organized effort of all the nations in carrying it out. With these views, the Chief Signal Officer, in 1873, repaired to Vienna to attend the International Meteorological Congress, convened in September of that year; and, as the official representative of the United States, he laid before the Congress a proposition to the effect, "That it is desirable, with a view to their exchange, that at least one uniform observation, of such character as to be suitable for the preparation of synoptic charts, should be taken and recorded daily and simultaneously at as many stations as practicable throughout the world."† This proposition—the first ever made under such auspices—involving the immediate, actual undertaking, on a world-wide scale, of a work whose magnitude had so long intimidated others, met with the unanimous concurrence of the Congress. And in November, 1873, a few weeks after that body adjourned, the Chief Signal Officer was enabled to state to the Secretary of War, at Washington, that arrangements had "already been made with the meteorological offices at St. Petersburg, London and Constantinople to commence the exchange by mail of one, daily, simultaneous report, taken over the vast territorial extent of the Russian and Turkish empires, the British Islands and the United States." Energetic efforts were then made to perfect and extend this comprehensive and arduous enterprise, now for the first time set on foot through the zeal of its American author. The example of the Russian government and others, of entering into this work as proposed at Vienna, was rapidly followed by the governments of Austria, Belgium, Denmark, France, Algiers, Italy, the Netherlands, Norway, Spain, Portugal and Canada. So that, in the fall of 1874, General Myer officially reported: "The concurrence of so many nations, representing a territory cov-

* Report of the Chief Signal Officer for 1872, p. 86.

† Report of the Chief Signal Officer, 1873, p. 311.

ering the larger inhabited portions of the Northern Hemisphere, seems to put beyond question the ultimate success of the undertaking to secure daily a simultaneous report of the meteoric conditions over the greater part of the earth's surface," and then, November 1st, announced that "the issue of the International Bulletin of Simultaneous Reports had been commenced."† The national coöperation of Greece, Norway, Dutch Guiana and Japan, and that of numerous scientific associations, speedily ensued and greatly enlarged the scope of the new service planned and prosecuted at Washington; and, in 1875, the Naval forces of the different powers were solicited to extend the plan of simultaneous reports upon the seas. The Sandwich Islands, the West Indies, the East Indies, Mexico, and the United States Navy with the Medical Corps of the Army, in 1876 and 1877 became actively enlisted in rendering daily reports taken simultaneously with those of the Signal Office at Washington, and helped to swell the volume of observations desired by its chief. The scheme which he had laid down and carried to Vienna in 1873, and which had been there accepted by the Meteorological Congress, has been steadily pursued, with steadily increasing auxiliaries and an ever-widening horizon of promise, from its inception to this present time.

The Northern Hemisphere, hitherto the chief field of its investigations, is eminently the *land-hemisphere* of the globe, containing, according to the estimates of geographers more than three-fourths of the entire solid terrestrial surface. "If we compare the *North with the South Temperate Zone*, says Prof Ansted, the English geographer, "we find the land nearly *as thirteen to one.*" The international weather system, in covering as it now does, the entire North Temperate Zone, excepting some sparsely-settled portions of Central Asia, already spans nearly thirteen-fourteenths of the temperate regions of the earth, upon whieh are congregated by very far the largest part of the human family, and where all the greatest interests of man center—the regions, in a word, in which all the practical applications of meteorology can most effectively and extensively subserve his welfare.

Just here, it may be proper to state, the novelty or originality of this system, as it was proposed for the first time at Vienna in 1873, chiefly consists in the collection of *strictly simultaneous* observations, both on land and sea, and their utilization in studying the atmosphere *as a whole*. Accuracy and science alike require us to distinguish between "simultaneous" observations and those usually termed "synchronous." The term "synchronous" has often been used to characterize observations taken at a given hour over large areas, but with the understanding that each observer follows *his own local time*. An international corps of observers, stationed on different meridians, taking "*synchronous*" observations, would, therefore, be all reading their instruments at *different moments or hours of time*: an observer at St. Louis would read six hours after the London observer; and those separated by a greater or less distance than divides these two, would report at correspondingly greater or less intervals, so that their reports would not

† Report of the Chief Signal Officer, 1874, p. 88.

be strictly adapted for inter-comparison, nor could they faithfully mirror the aerial movements, the translations of storms, etc., as they actually occur. However useful *synchronous* reports might be, they could never yield the results obtainable from the *simultaneous*, as adopted at Vienna—a distinction which, we find was once forcibly remarked by Admiral Fitzroy. That honored meteorologist was never the author nor founder of any International system of simultaneous reports, but he said in 1863: "In General Sabine's recent lecture at Cambridge on Magnetism, the term 'synchronous' is applied to observations made at the same local hour, around the world, but these are *not simultaneous*. Truly, indeed, these are synchronous, but not in the sense that is required for occurrences happening simultaneously or synoptically, referred to time or view, at one place only, and on one meridian." [Fitzroy's Weather Book, p. 103, London 1863.] The value and beauty of every weather system, especially of an international weather-system (some of whose observers must be at antipodes, and, hence, if observing at "*the same local hour*," must report twelve hours too soon or too late) are clearly dependent upon its securing observations taken every day when *the sun reaches a given spot in the heavens*. Otherwise, confusion, maziness and uncertainty attach to the very data from which, by inter-comparison, clear light is sought, and the study of the atmosphere as a unit fails. The great desideratum is to get such data as, when charted graphically, will afford the meteorologist a *bird's eye* (synoptic) *view* of the aerial ocean. This is secured by the plan originally proposed by General Myer at Vienna. With this explanation, we hasten to describe the practical execution of this plan at the Army Signal Office in Washington.

The "*Bulletin of International Meteorological Observations*" may first engage our attention. The prime feature of this publication, as intimated, is that all the observations it records, are *taken simultaneously*, or strictly at the *same actual moment of time*, in every part of the world. The moment fixed for observing is 7:35 a. m. Washington mean time, which is 0:43 p. m. Greenwich mean, time 0:53 p. m. Paris mean time, 1.37 p. m. Berlin mean time, 1:49 p. m. Vienna mean time, 2:44 p. m. St. Petersburg mean time, 1:33 p. m. Rome mean time, 6:36 p. m. Calcutta mean time, 10:23 p. m. Melbourn mean time, 10:02 p. m. Tokei (Yeddo) mean time, 2:12 a. m. Honolulu mean time. 7:25 a. m. Toronto mean time, 6:07 a. m. Mexico mean time, etc., etc. Thus, whether it be morning, noon, afternoon, evening or night, when the fixed moment arrives at any station, the observations are taken—without respect to the local position of the sun—so as to give data, from which the student may approximately chart the conditions of the atmosphere as they actually co-exist in every part of the wide field of observation, at one and the same point of time.

The *simultaneousness* of all the observations that enter into the *Bulletin* is the feature of greatest importance. * For it is clear, if the observers of one country read off their instruments at an interval of time different from that at which other observers did the same, their reports would not be suitable for comparison, and might seriously mar the integrity of the general result. If all the co-operators took

their observations, say, at 6:00 a. m. mean time of the capitals of their respective countries, their reports would be confusing and incomparable, and no accurate deductions could be based upon them. Such reports might be *synchronous*, but not *simultaneous*, in the strict sense in which we here employ the latter term. The object of all meteorological observation is to get the facts necessary to construct, each day, a graphic sketch (if we may so speak of photographic faithfulness) of the atmosphere as it is, and not a distorted view of it. It is manifest, therefore, that nothing less than observations *strictly simultaneous*; or as nearly so as the imperfections of artificial time-keepers will admit, can ever adequately or satisfactorily meet the requirements of such research.

This "Bulletin" combines more than thirty series of observations. These are the Algerian, Australian, Austrian, Belgian, British (with Marine series), Canadian, Costa Rican, Danish, French, German, Greek, Indian (East), West Indian, Italian, Japanese, Mexican, Netherlands, Norwegian, Portugeese, Russian, Spanish, Swedish, Swiss, Turkish, United States, and United States Naval Series, with the Pacific Mail S. S. Co. Marine series, and other marine series, as those of the White Star Line, the Occidental & Oriental S. S. Co., the North German Lloyd of Bremen, the American S. S. Co., the Red Star Line and the Allan Line. The number of observers reporting exceeds 550, not including those at the Cape of Good Hope, Mauritius, Melbourne, and Hobart Town, in the Southern hemisphere, and one or more, whose reports form the British "Sub-series." This large co-operative force, taking simultaneous observations every day, enter the readings of their instruments and remarks on the weather upon their blank forms, or on suitable sheets, and forward them by mail to Washington. The observations, when received at the office of the Chief Signal Officer there, are collated, tabulated, revised and printed, making a daily Bulletin, quarto size, of 12 pages.

The accuracy and skill with which the observations are taken, as also the estimate put upon the practical value ultility of the results deducible from them by those best fitted to judge, may be approximately inferred by glancing at the various classes of observers so diligently engaged in this international work. These include forty-nine naval commanders, fifty-one steamship and ship captains, two ministers of public instruction, and twenty-three directors of royal and imperial observatories, heads of meteorological institutes, and secretaries of central meteorological councils and societies, with their respective bands and corps of observers, representing hydrographic officers, normal schools, physical societies, astronomical observatories, naval academies, engineers, etc. The zeal, attainments and facilities enjoyed by such men as form the international corps ought alone to suffice as both a guarantee and an assurance that their work will be of the most exact and most useful character. Probably, no equally expert and experienced force of voluntary collaborators were ever engaged in any similar enterprise. Before losing sight of the Bulletin, we should notice the items of the observations which appear on its pages. These, as given in the reports of the observers at

land-stations, consist of the barometer readings reduced to sea level, and give both in inches and millimeters; the readings of the thermometer both by Fahrenheit and Centigrade scale; the relative humidity of the air, per cent.; wind, direction, velocity and force; the clouds, both upper and lower, and both the amount of cloud and direction of its motion, the rainfall and melted snow in the previous twenty-four hours in inches and millimeters; and the state of the weather, at the taking of the observations, including notes of fog, mist, rain, snow, color of sky etc The barometric readings in separate columns, are given as reduced to freezing and their respective standards.

In the Marine series—the reports by ship captains—the sea-swell is noted, in addition to the other items; and each ship's position at the time of observing is entered with her name. The sea-swell is an important item as sometimes furnishing a strong indication of the passage of a storm-center, while yet distant, and may afford a clue both as to its direction and intensity.

The records which appear in the *Bulletin* are copied from the regular exchanges of the office, and, with each series, the necessary notes as to wind-scale used, correction etc., are supplied. To secure the greater accuracy and uniformity from marine observers, all captains are invited to compare their barometers with a standard barometer, placed by the chief signal officer (kept under lock and key) in the Merchants' Exchange reading room in San Francisco and at the Maritime Exchange in New York.

The first number of the present series of the International *Bulletin* was published at the Washington office, January 1, 1875, the accomplishment of which was made possible by the data furnished from different parts of the world, in response to separate letters addressed by General Myer to the different nations in 1873.

The first step toward the utilization of the great mass of data, daily received and recorded in the *Bulletin*, is to chart it. The *International Weather Map*, presenting in graphic and partly pictorial forms the atmospheric conditions throughout the immense area of co-operative research, is an epitome of the *Bulletin*, and enables the eye of the student easily to catch the salient features of the weather. Without it, the *Bulletin* with its long columns of figures would but slowly repay his study, if it did not confuse his mind with the very multiplicity of items. With it before him, almost at a *coup d'œil* he can distinctly trace the great areas of high and low pressure, the belts of high and low temperature, the predominant air-currents, rain and cloud-areas; he can locate the troughs and crests of the great aerial waves, and can distinguish the centers, dimensions, outlines, and even estimate the intensities, of the cyclonic storms, that are simultaneously sweeping across his vast field of vision. This invaluable aid to the study of the data is first drawn on a large, tinted sheet, or blank map, the map being on a Polar projection, twenty-two inches in diameter, covering the northern hemisphere, and representing fragments of Africa and Australia. This large map, printed in blank form, for daily use in the office, first receives the entries of the observations tabu-

ited in the *Bulletin.* The cartographer, having received the day's bulletin, transfers to each station on his printed and colored chart the bulletined reports belonging to that station, representing the winds by arrows, the cloudy and clear weather by appropriate symbols, and the barometric and thermometric data by numerical figures. When all the items are entered on the tinted chart in their proper places, he proceeds to draw the Isobars (or lines of equal pressure) in red, and the Isotherms (or lines of equal temperature) in black. These lines, shaped by the recorded data, when completed, bound and define the great areas of high and low barometer, and also those of high and low thermometer, and indicate the position, contours and centers of the prevailing storms. The barometric areas are graded and marked "HIGH," "HIGHER," "HIGHEST," and "LOW," "LOWER," "LOWEST," and the chart is done.

When thus filled up and finished, if approved, the Isobaric and Isothermal lines are traced on tracing linen, laid over the chart, and then transferred by the heliotype process to a reduced form of the original chart, upon which the Isobars appear in black and the Isotherms in red. This reduced form of the original chart is finally printed and published, as an accompaniment to the Bulletin. Upon the *published* chart, only the Isobaric and Isothermal lines, with their numerical values, are given. But, with the aid of the Bulletin, the reduced chart (eight and a half inches in diameter) is sufficient for general use among the co-operating observers, to all of whom it is sent.

We have spoken of the International Weather Chart as an invaluable auxiliary in the study and utilization of the International Bulletin. This chart is as important to the meteorologist, as the ocean-chart is to the navigator. Not only does it give him a clear idea of the meteorological conditions as they coëxisted at the moment of observing on any particular day, but, with the series of daily charts before him, by running the eye over them successively, the developments of the weather, the movements of the storm-centers and their velocities and influences become apparent. The inspection of several such, successive, daily, graphic charts familiarizes the eye with the phenomena of the atmosphere, while it also enables the student to *picture them in motion* before him and to watch the play of the mighty forces which conspire to produce them. In a word, the whole series of the charts based on the combined data of the International Bulletins presents, as it were, a panoramic view of the atmospheric ocean, as it rolls its ever restless waves and bears its revolving gales around the Northern Hemisphere.

Better to understand the construction and use of these daily charts, it should be stated, that they contain (1) Data, as appearing in the International Bulletin of similar date (2) Gobars, in black, exhibiting the atmospheric pressure at sea-level, which are charted from simultaneous data as represented by the several observers, (3) Gotherms, in red, exhibiting the temperature of the air, similarly charted—the lines being broken or dotted wherever the data are incomplete, or there is a missing link in the chain of observations. The arrows, when charted, fly with the wind and exhibit the direction and force of the wind, in a way to facilitate the study.

In entering the large mass of facts reported, great care is necessary to enter them in their proper places, geographically. This is done by means of an index map, on which the names of all the reporting stations are entered with a number of its own attached to each station. By glancing at the corresponding number on the International Chart, the cartographer sees at once where each station's report is to be inserted, the number on the chart serving in lieu of the name of the station. By employing this expedient, while the utmost accuracy is attained, and every observation gets into its correct geographical place on the chart, the latter is freed from the crowding and blurring which would be unavoidable if all the names of stations were printed on its face; the risk of misplacing the data on the chart is lessened, and the draught when completed gives greater clearness and relief to the phenomena themselves.

An incidental, but by no means insignificant advantage of the cartographer's work is that it serves as an effective *check* on the observations as entered in the Bulletin. For, if an error of an instrument's reading has been bulletined, when it comes to be entered at its proper place on the chart, the draughtsman's eye is arrested by its incompatibility with the associate readings, and he must needs ascertain the correction before he can proceed with his plot. Thus, indirectly, the charting of the data furnishes a test and a corrective of the Bulletin, and also, if necessary, of the original reports as forwarded by the observers.

These items of the work may seem to be small matters of transient moment. But they are far more. It is by steps, cut, one by one, in the crumbling rock that the traveler, emerging from the over-shadowed valley and seeking to scale the declivities towering above him, must often make his upward way. So must it be with the meteorologist essaying to gain higher view-points in nature. To him, therefore, every such simultaneous or synoptic chart offers another foothold for ascending to a higher plateau of research, whereon, in a clearer and more luminous sky, he may command an immensely enlarged horizon, and intelligently, mutely, survey the magnificent and mighty mechanism of the atmosphere. The Astronomer Royal, of England, when testifying, last year, before a government committee at London, said, "that, before meteorology could be developed as a science proper, there must be more numerous observations, from more numerous stations throughout the world, by means of which to construct daily weather-maps." This deliverance but echoes the concurrent testimony of many meteorologists; but long before its authoritative utterance on the occasion mentioned, the plan it suggests was in process of practical execution by the Army Signal Office at Washington, from which the actual issue of daily International Weather Maps commenced on July 1st, 1878. Of course, the daily International Weather Map is the first-fruit —the efflorescence—of the whole body of simultaneous international observations; and must depend, for its maintenance and improvement, upon the development of the latter. But, if the observers now in the field be encouraged and their number multiplied, and judiciously located, so that the materials for the construction of the chart are abundant, we may venture to anticipate, it is destined soon

to prove the most fertile agent of meteorological discovery—the most knowing, trusty and communicative guide into the misty domain of atmospherical phenomena —whose aid has ever been invoked by the investigator.

"In vain," says Prof. Hughes, "would the ingenuity of man be excited in determining the form and magnitude of the earth, and the positions occupied by different places upon it, if he were unable to adopt some method of making these observations *apparent to the senses.*" The remark applies in any study of the atmosphere with as much point as in geographic pursuits. The maps of Columbus were, doubtless, to his mind, indispensable and invaluable auxiliaries in maturing the reflections which utimately led him to embark on his voyage to the new world, as they were his guides on the way. No less valuable will the meteorological charts be for all future exploration of the aërial world, whose forms are less palpable and distinct than those of the globe which it envelopes, and, hence, have more to gain by being *pictured.* "If the making intelligible and bringing into subjection of the varied, unwieldy and almost unmanageable mass of materials by the simple employment of the element of form, be," as Carl Ritter said twenty years ago, "the great improvement in the science of geography," we may infer what the modern weather-chart is capable of achieving for meteorology. The terrestrial chart can only represent the earth in repose. But the series of daily, colored, synoptic charts puts the atmosphere before the eye in *pictured action.*

The preparation and printing of these for use at the Signal Office began on October 1st, 1877; but, their *daily publication*, as we have said, dates from July 1st, 1878. The series issued is unbroken, from this last-named date, and will be regularly continued, and forwarded to all offices and observers on land and at sea coöperating with the Washington Bureau. The study of the Earth's meteorology thus made easy, opening the attractive and awe-inspiring volume of nature—radiant reflection of its Creator, and rich in types of His invisible things—must, when once made known, possess a charm for many besides the scientist and the seaman, and hold every right mind in delighted contemplation.

We have already, in a measure, anticipated and answered the question of the *utility* of this vast system of International Meteorology. But, doubtless, there are not a few, who, though viewing it with no hostile spirit and who are ready to accord to scientific research generally, its real and full worth, inquire, What are the substantial advantages this system can promise? Such an inquiry is not impertinent, but is entitled to receive a specific answer, if the friend of the system can render one. For blind, aimless research is no research at all. While, then, it is not our object to vindicate or to disparage the system, we may briefly indicate some of the utilities which, in our judgment, lie within its reach.

Apologetically, we may premise, that, at the least, the fact that so large a corps of observers, numbering so many of the ablest scientists of the day, and so many practical seamen, both naval and mercantile, are lending their thought, time and toil for the work, affords strong presumptive and *prima facie* evidence

of the utility and extensive practical advantages that may be realized by the vigorous prosecution of international meteorology. It is hard to believe that such a force of shrewd coöperators would invest their talents and industry in this enterprise, had they no assurances of substantial returns, and did they not know it to be far from a Utopian waste of their pains. Not a few of those actively engaged in furthering these researches belong to a class, incredulous of new things and slow to take hold of anything wearing the aspect of inulitity.

Although this system, as now prosecuted, is novel, there are not wanting some precedents, which afford us the means of estimating its probable value and of ascertaining the results that may reasonably be expected to accrue from its maturer and unique method. Let us glance at one of these precedents. In 1853, in accordance with a plan of concerted research, arranged at the Brussels "*Maritime Conference*," the United States collected and utilized an immense mass of marine observations, and, through the labors of its "National Observatory," prepared and published the results deduced from them. The "Wind and Current Charts," and the "Sailing Directions," of Lieut. Maury, based on the data then collected, were and are to-day esteemed, by maritime men, of incalculable value to navigation and commerce. By the use of the deductions, (which, but for this work, had ever remained impossible,) invaluable light was shed on the dark points of the ocean physics and meteorology, and some of its gravest problems received an early and easy solution. Tentative and defective as was the system proposed at Brussels, and confessedly inadequate as were the materials within reach of its executors, the remunerative yield of practical benefits exceeded the most sanguine expectations of its friends. By the application of its results to the mariner's perilous work, the safety of his vessel was greatly increased; new and more propitious paths across the trackless waters were discovered, and the tedium and expense of long voyages greatly diminished. The voyage for sailing-vessels from England to Australia and back was, thereby, shortened, according to nautical authorities, not less than two or three months; and the average time of such vessels from New York to San Francisco was soon reduced from 180 to 100 days—a saving of over 40 per cent. of the time formerly consumed at sea and, consequently, a very material lessening of the costs and perils of the voyage.

The system set on foot at Brussels in 1853, was not a system of international meteorology; but, more strictly speaking, of *ocean-research*. It was, as we have intimated, tentative and provisional, designed to feel the way into the unexplored phenomena of the sea, and to elucidate its physical geography and meteorology. It made no arrangement for the collection and discussion of observations extending over the land surfaces of the earth; it made no serious attempt to investigate the atmosphere of the globe as a unit; nor did it institute simultaneous meteorological observations. And, whatever concert of the nations it at first had, its systematic prosecution as an international work had been suspended long before the assembling of the Meteorological Congress at Vienna, in 1873. But, if with all its drawbacks, its scanty materials, and observations unavailable for rigid inter-com-

parison, the old system of ocean-research could achieve so many useful results, and in so short a life-time, how much more may be justly expected and shortly realized from the new and far more comprehensive system of international research? The latter, as now worked, gathers to itself, at least for the northern hemisphere, richer and more reliable materials, out of which to construct and elaborate even the meteorology of the ocean, than ever the former system could command; while it also enters well-equipped, a field of vast expanse, into which the maritime Brussels' Conference, in 1853, could but wistfully, though hopelessly look. The two systems of research, though possessing some common characteristics, differ widely in their aim, scope, machinery and method of procedure. But, if the earlier system be taken as a precedent, by which to prognose the future of the later and larger system, we must admit that the latter is capable of furnishing incomparably better results. But, to come to the more specific statement of the benefits that are likely to be obtained from the accumulation and publication of the data in the International Bulletin and Chart. One practical application, to which they may soon be put by competent meteorologists, is the elucidation of the long-agitated questions of the *oceanic storm-tracks*—particularly the *Trans-Atlantic tracks of American storms*, after leaving our coasts and moving toward the British Islands, and the determination of *how far the approach of these cyclones toward the British coast can be predicted by the American storm-warner.* This is a problem affecting every interest of the inter-commerce of Europe and America: Do storms of a given type, in certain months, when confronting areas of high and low pressure of certain gradients, make their trans-Atlantic paths from the eastern coasts of the United States toward Iceland, or toward England; or, do they take a more easterly course toward France, or, further, do they recurve with the North Atlantic drift-current southwardly, around the Azores?

It is confidently asserted, that a number of predictions of the probable arrival of American storms on the British coasts have been successfully made from this side of the Atlantic, by amateur enterprise. Without now attempting to analyze these private predictions, or passing judgment on their merits, we may safely affirm, that, if one-half of their reported successes can be substantiated, the fact would argue immense practical advantages to be, in future, derived from the more scientific and systematic use of the International observations and charts. The amateur work referred to must, necessarily, be done with very inadequate facilities and in the absence of much light derivable from the International Charts. When these are subjected hereafter to the rigid analysis and discussion of the most expert and sagacious meteorologists. If, thereby, in the proximate future even two or three of the great Atlantic storms that ravage the sail-whitened offings of the British coasts can, every year, be foretracked and their destination be telegraphically and officially announced to the threatened European districts, the life-saving and property-saving thus effected would amply compensate for all the labor and expense of the international system, to which such timely storm-warnings would owe their success. Amateur essays, in this direction, however defective in

their methods and uncertain in their conclusions, may nevertheless, show what can be done, when the simultaneous observations and charts now accumulating at Washington shall have been subjected to the the maturer study and discussion of trained investigators well-versed in both the practical and scientific processes of official weather-prediction and weather-research. But, whatever may be the verdict as to the proved results of the present private endeavors to pre-announce trans-Atlantic storms impinging on the British coasts, there are manifest and cogent reasons for assuming that the development of the public international system which we have been describing, will ultimately enable skillful meteorologists to give timely warnings of some of the great cylones, which, first felt on this side of the Atlantic, rapidly extend their widening circles of disturbance eastward across its unresisting bosom, and finally, unsuspected, pour out their long-accumulating fury where the world's ships and navies most congregate, on the eastern shores and islands. The difficulty of hereafter making such premonitory announcements may not be so great as it now appears. The North Atlantic basin is long, *trough-shaped* and comparatively *narrow*, its shores converging toward Iceland; so that the liquid plain, over which the cyclones to be pre-announced must move, affords them but comparatively little room for very eccentric and wide deviations, and thus, in their northeastwardly advance, they can hardly fail to make their dangerous marginal winds felt in the shoaly and land-locked waters of Great Britain. The force of this last remark will be made more apparent if we consider the diameters of the great cyclonic disturbances in question, which, according to Buchan, average 1,200 miles. If we locate the center of such an immense meteor in the narrow Atlantic, midway between Newfoundland and France, and give it the eastwardly motion which the Atlantic hurricanes usually have, it is difficult to see how it can pass to the north or south of the British Islands without ultimately creating disturbances, premonition of which would very materially benefit the shipping around these Islands. The day will never arrive, perhaps, when even premonitions* of approaching cyclones cabled from the United States to England may not sometimes fail or miss fulfillment. But, with the enlargement of the "Marine Series" of simultaneous observations, the development of the Interna-

* Possibly *premonitions*, (not predictions) of trans-Atlantic storms may be the most that will ever be accomplished. But these would be far from valueless. A recent investigator has examined seventy-seven storms near the coast of the United States, only twenty-eight of which, was he able to trace, with considerable confidence entirely across the Atlantic to the European coast. But, considering his fragmentary data, no deduction can be made from them, conclusively, or that would not be premature. Two things, we conceive, are necessary to enable an American meteorologist to send reliable warnings to Great Britain. I. He must have some reports of the storm from steamers or vessels arriving at the northern or eastern ports of the United States, within a brief time after their encountering it; so as to obtain some idea of its *altered* course and intensity after it got fairly on the sea. The tendency of cyclones after leaving the United States is to increase in intensity on reaching the "Gulf Stream" drift-current; and one or two barometer readings giving the bearings of the storm-centre, when yet only a few hundred miles from these coasts would go far toward determining its final track. II. He must have some cablegrams from the other side, sufficient to give him the general conditions of pressure prevailing over western Europe, two or three days before he expects the storm to reach it. The necessity of these will be noted presently (see above). Can these two conditions be measurably complied with? We can see no reason why they may not. With reports from incoming steamers, telegraphed from Sandy Hook, Boston, etc., and a brief cipher cablegram from England, giving general data, chief obstacles to sending *premonitions* of the storm would be measurably removed.

tional Charts, and the study and discussion of the masses of data now being collated at the office of the Chief Signal Officer, we may not unreasonably expect that occasional premonitions or "indications" of selected storms can with considerable confidence be telegraphed from Washington to London, and prove most valuable to Great Britain and Northern Europe. These considerations may suffice to show all British and European merchants and seamen how deeply their interests are involved in the prosecution of this system of international meteorology, and how important it is that all steamship captains and other shipmasters should undertake the interesting task of making the simultaneous observations and forwarding them to the Chief Signal Officer at Washington. Every such co-operator, besides rendering valuable aid to his own craft, and increasing his skill as a navigator, will receive in return a printed copy of the International Bulletins, with the beautiful International Charts for every day in the year.

Not less important to European meteorologists, charged with the official duty of making timely forecasts and issuing storm warnings for their respective countries, will the International Bulletins and Charts now prepared at Washington necessarily prove. "About half the storms of middle and northern Europe travel from southwest or west-southwest toward northeast or east-northeast; and nineteen out of every twenty, at least, travel toward some point in the quadrant of the compass from the northeast to the southeast." This estimate of Mr. Buchan, an experienced British meteorologist, is, substantially, confirmed by all.

And Mr. Scott, the Secretary of the Meteorological Council, London, in his recent book, "Weather Charts and Storm Warnings," apologizes for the very partial success of the official storm predictions made in London, by referring his reader to the present impossibility of obtaining weather reports from the region lying to the westward of Great Britain. He tells us he cannot hope for very great success in predicting British gales unless he could anchor a floating station, 600 miles west of England, in 1,000 fathoms of water, reporting automatically by cable to the central office at London; and he very justly concludes that the problem of fixing and maintaining such an observatory is not very near its solution. The helplessness of weather telegraphy and storm warning in England, by reason of the geographical relation it sustains to the great Atlantic storm movements, is so great that the call has been made for a cable to the Azores, or to Iceland. "With daily telegrams from the Azores and Iceland," says a Scottish meteorologist, "two, and often three days' intimation of every storm which visits Great Britain could be had."

But such relief is, in all probability, very remote. In the meantime, the light which may be derived, by British and continental meteorologists generally, from the study and discussion of the International Weather Maps published by the United States Army Signal Office, ought to enable them to very materially increase the confidence and accuracy of their storm warnings. For some years to come, at least, these charts appear to offer the best material, and, perhaps, the only new resource for European meteorologists with which to improve their pre-

dictions of the great cyclones which invade their continent and its outlying islands from the Atlantic, annually strewing their coasts with the bones of so many gallant ships and the ruin of so many valuable cargoes. Certainly, the immense stores of observations elucidatory of Atlantic meteorology and its connection with European meteorology, now collated at Washington and reduced (in the International Charts thence issued) to graphic and didactic forms, which speak more than volumes of figures, and are easily studied, hold out a promise of a great boon to all European official co-operators, and, eventually, to the interests they represent.

Mr. Scott, of the London office, has strongly spoken of the "prodigious disadvantage" under which that office labors in preparing storm warnings for the United Kingdom (which he ascribes to the fact that "most" of the storms visiting it "come from the westward" of their advance stations), and, consequently, of the great need his official co-laborers have to study every storm they can chart, in order to learn the precise circumstance in which to issue future warnings—facts which go to show how indispensable the American International Charts will be to the London meteorologists.

A third specific and practical use of these International Charts is, that they will admit of approximate deductions of the mean *Storm Tracks*, or belts of territory over which, in each season, the great aerial depressions are wont to move as they feel the resistance or attraction of other and influential forces. It is true, no two storms may pursue the very same path. But, if the mean storm track for any portion of the earth's surface is laid down from sufficient data, and that track is spread before the eye in the weather charts, the problem of prevision for any special storm center known to be near the general track, is measurably simpified, or narrowed down. If multiplied simultaneous observations, ranging through a number of years, or meteorological cycles, could be charted, and the average tracks, in latitude and longitude, of the storms of that period be drawn, a considerable advance toward accuracy in predicting the courses of individual storms would be assured.

The utilization of the international data for securing such an advantage, has already begun to take definite shape in the preparation of monthly charts of ocean storm tracks. These charts (entitled "International Meteorology—Ocean Storm Tracks") were first published by the Chief Signal Officer, in November, 1878, to accompany the "Monthly Weather Review, for the General Weather Service of the United States." They are similar in size and style to the Daily International Chart, and are founded upon ship logs, press reports, and the simultaneous observations of the international corps. These new monthly charts of ocean storm tracks exhibit the paths pursued by all storms reported from the entire oceanic surface of the Northern Hemisphere, lending the "Weather Review" of each month an interest and importance which it has never before had. From them, the seaman can readily learn the history of the hurricane which he has encountered, and trace its passage across the field of observation.

"It is one of the chief points of a seaman's duty," said an old navigator (Captain Basil Hall) "to know where to find a fair wind." It would appear no less his duty to know where he will encounter a foul wind. And the familiarity he can so easily acquire with such storm track charts, will obviously help him to the latter kind of knowledge as no other aid ever before offered him could so well do.

Of course, any deductions of averages or of mean results from the charts of ocean storm tracks (published with the "Weather Review" every month and presented to volunteer observers) are only provisional; but, when the data have sufficiently accumulated, the mean monthly tracks, for a series of years, can readily be deduced and charted. Such final results would be of great value to all who "go down to the sea," guiding them into those paths, shifting every month in the year, wherein they may make the safest and speediest runs.

We have dwelt on these aspects of the international weather service which effect the maritime centers of Great Britain and western Europe, and reflect light on the sea routes converging thitherward, because around and upon them gather and move the largest fleets of the world. They are the centers of trade and intercourse for all the nations. No system, of the kind we have been reviewing, can afford additional security to the vessels bound for and leaving the ports of England and western Europe, without, directly and indirectly, contributing to the good of all nations, in an eminent degree; for the eastern side of the North Atlantic Ocean is the world's chief maritime rendezvous.*

But, finally, the chief immediate utility which is claimed for this extensive system of research, by its scientific advocates, is that it opens the door for the investigator into the grand laboratory of the Atmosphere; that, by its collection and charting of exact simultaneous (and, therefore, intercomparable) observations, it enables the meteorologist to study the atmosphere in the aggregate, to define its laws, and to discover not only its *local*, but its *general* phenomena over vast portions of the earth's surface, as they co-exist and co-operate. To unscientific minds, this may appear a remoter and less palpable benefit than the direct application of the system in behalf of navigation and storm warning. But the latter can only follow from the former; or, at least, we may say they must move forward *pari passu*. If meteorological research is worth prosecuting, and its deductions are to improve, it would appear indisputable that its pursuit needs to be pressed beyond national, and even beyond continental limits, as is now done by the new system. "The atmosphere," as Commodore Maury has said, "is a whole, and, for its influences to be rightly understood, it must be treated as a whole." † Of course, this is only approximately possible. But all that man in his present state can do is only an approximation toward the ideal of excellence. We venture to affirm that the present international service is the longest stride ever yet made toward realizing the true ideal of atmospheric research.

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* The number of vessels reported as entering and clearing at the single port of Liverpool, in one year (1871), was 26,828, with a tonnage of 11,821,145. (*Nautical Magazine*, London, 1873, p. 121.)

† Speaking of the general international work of both land and sea meteorology, this investigator said, in 1855: "I hope the matter will be taken up by abler and stronger hands by far than mine." (Int. to Sailing Directions.)

The Chief Signal Officer expresses the opinion that, by the studies that will be made possible by the International Charts, "the questions as to the transitions of storms from continent to continent, and of the times and directions they may take in such movements; the movement of areas of high and low temperature; the conditions of temperature, pressure, and wind direction existing around the earth at a fixed instant of time, permitting thus the effects of day and night to be contrasted; the distribution and amount of rainfall; and others, many and valuable, only suggested by this enumeration, may be settled."

If this estimate of the utilities of the charts seems to any one too sanguine, an illustration from the charts themselves may show their real value and enable any one to gain some correct ideas on these points.

Let us take a single example. We will turn to a small collection of these charts lying before us, and, almost at random, refer to an instance of a cyclonic storm, of December, 1877—one not the most favorable that might be selected from the charts, if our object were merely to sustain their author's opinion. Upon the chart of December 1, this depression first comes into view; it was at 7:35 a.m. (Washington mean time), resting central over southern Greenland, where the barometer was reading 29.00 inches. The next day, at the same hour, the chart shows the cyclone had advanced slowly to the southeastern coast of Greenland, the barometer still 29.00 inches. By the morning of December 3, that day's chart shows that it had moved very slowly off the southeastern coast of Greenland, the barometer falling to 28.80 inches. The charts of December 4 and 5 clearly reveal its steady progress southeastwardly—toward the British Islands. As it approaches the Scotch and Irish coasts, the barometers there, which had stood above 30.20 on December 2, have fallen below 29.70 (on the 5th), and the Atlantic isotherm of 50°, by the latter day, has mounted up in the storm's front from the latitude of 45° north to the southern extremity of Ireland—ominous indications of danger! That a serious disturbance is threatening Ireland, and imminent, must now be evident to the Central Meteorological Office at London, as its Irish telegrams come in. "Will it actually reach the menaced districts?" "Shall the storm signals be immediately ordered up?" The answer is doubtful. The morning of the 6th brings fresh indications of the storm's approach—barometers falling below 29.20 and thermometers rising above 50°. Again, the perplexing, anxious question, "Shall the signals be hoisted?" recurs. Certainly, looking seaward, the passage of the storm center over Great Britain appears inevitable. But wait. Looking over central and western Europe, the chart reveals the presence of an immense atmospheric wave—an area of high pressure, or *anti-cyclone*—with barometer at the crest over 30.80! its western slopes streaming out over the German Ocean and the Bay of Biscay, and rapidly moving westward to oppose and beat back the advancing cyclone. The London storm-warner knows that this wave will serve as an effectual wall to prevent the Atlantic depression from making any further easterly advance, and that the storm center will be forced to find another path than that which it had threatened across the United Kingdom.

He, therefore, dismisses his fears, and orders no signals. The morning of the 7th comes to confirm his conclusion; the danger is overpast; his barometers are rising, thermometers falling—sure pledges that the baffled meteor is retiring, however sullenly, before the pressure of a superior force. The morning of the 8th, the gale (whose van on the 6th had actually assailed the Hebrides) has rapidly retreated northward to the Sea of Greenland, there to wreak its violence upon the polar icebergs, instead of upon the shipping of the world in British waters.

This is only one of many illustrations, based on the *actual* data laid down on the international charts for December, 1877. An examination of a series of these charts, we have no hesitation in saying, will supply numerous and more signal examples of the beautiful and incalculably useful study and instruction opened up, with ever fresh interest, by their exact and graphic delineations of the simultaneous atmospheric movements. The meteor just noted was a straggling storm on the outskirts of the field of research, and, therefore, not so fully within the purview of the system as many others that might be cited. But, from the international charts, which faithfully mirror its august movements, it must be clear even to those unitiated in such study, that much light may be gained, both as to the general laws of storms and as to the special conditions which control their progress toward the ship-crowded waters of western Europe. Had the high-pressure wave on the continent (it had been present there from the 1st to the 6th of December) been slowly giving way before the Atlantic cyclone on the 5th and 6th, the latter, relieved from opposition in its front or eastern side, would manifestly have continued its advance upon Ireland, and, in all probability, have ravaged its coasts and the neigboring seas.

If it be just to lay the blame of defective storm-warning in England upon the "prodigious disadvantages" under which its official meteorologists labor, in having no stations to the westward to notify them of approaching Atlantic storms (and we do not reject this apology), it nevertheless, in our judgment, remains incontestable that, with the aid of the luminous international charts, and the receipt of daily telegrams from all Europe, revealing those aerial conditions which permit or prevent the invasion of their island by an Atlantic cyclone, to say nothing of premonitions that may be cabled them from the United States, such an invasion, by any storm of very great intensity, wholly unannounced by the London office, will ere long come to be regarded as irreconcilable with its claims to popular confidence.

We shall not go far amiss if, in this connection, we repeat the remark of one of the most discriminating and widely known scientific journals of England, *Nature*, commenting on these charts. That journal, in an article headed "International Weather Maps," published February 15, 1877, said:

"We may earnestly hope that the navies and the mercantile vessels of all civilized countries will soon join in carrying out this magnificent scheme of observations, originated by the Americans in 1873, and since then further developed and carried on by them with the highest ability and success."

While we would unsparingly reprobate the resort to any species of that boastful and man-defying gratulation of scientific achievement, replete with vaticinations born of ignorance and living on baseless assertions, that have done more than aught else to disgust the thinking, and to frighten the sober from the legitimate investigation of nature, we may, nevertheless, refer to such an indorsement of the system which we have been reviewing, emanating, as this indorsement does, from a foreign and rival source.

The Chief Signal Officer, in one of his official reports, expresses the hope that, "by systems of observation thus extensive, generalizations may be had to permit the announcement of approaching meteoric changes for periods longer in advance than have hitherto been practicable." How far this hope may be realized, remains to be seen. But the development of the international service over the West Indies, the inter-tropical parts of South America, and Mexico, ought surely to facilitate the knowledge, and thus the prevision, of those destructive hurricanes that, gendered in the warm bosom of the equatorial ocean, emerge thence and furiously assail our Gulf-bordering and Southern States.

A better knowledge of the Pacific Ocean storm tracks, and their recurvation upon the western shores of North America, may justly, we think, be looked for from the study of the marine reports now furnished by the Pacific Mail steamship captains, and other co-operators. A long-felt want of weather-warning in the United States is greater provision for the Pacific and Gulf coasts, which can only be supplied as increased light is shed on the meteorology of the regions lying, respectively, far to the westward and southward of these exposed borders.

As this system of weather research is developed, and its charted data placed under the analytical study of scrupulous and experienced meteorologists, it can hardly fail to admit, incidentally, of useful application to hygienic and sanitary problems, into which meteorological elements enter sometimes as important factors. That its maturer deductions will not be valueless to the climatologist, it may reasonably be expected. But on these points it is unnecessary to dwell. Enough has been said to establish its utility in the domain proper of meteorological investigation; and this may well content those who are laboring to further it.

"Meteorology," to borrow the words of Mr. Buchan, "is eminently the science of observation and averages, and, before those inquiries now raised regarding the general movements of the atmosphere can be satisfactorily and adequately discussed, it is indispensable that the field of observation be extended, so as to embrace nearly the whole of the Northern Hemisphere"—words which, though long since written, have not been fruitless in more recent years. As they suggest, we may now add that the great desiderata of the International Weather Service at present are more extensive and earnest co-operation by those who are capable of making simultaneous reports, especially steamship and ship captains of all nations, and observers in quarters where there are gaps to be filled up, and, lastly, the discussion of the charts and the publication of the generalizations drawn from them. Perhaps we cannot better close this retrospect of a work of such magnitude, than

in the words of an eminent German surgeon, when reviewing the results of a novel and most difficult operation in conservative surgery: "The prospect of success it offers is such as to make the operator both *bold and modest.*"

TECHNOLOGY.

THE RELATION OF ÆSTHETICS TO INDUSTRY.*

BY V. W. CODDINGTON.

(*Concluded.*)

Among the abstruse elements of excellence are:

1st—Economy. Not economy of labor, but economy of material. A superabundance of material for a given purpose is just as undesirable as not enough. Nature in her methods of construction is always careful to use no more material than is necessary to accomplish her purpose, and the artisan who has not the skill to manipulate a minimum amount of material for a given purpose betrays an unmasterly hand.

2d—Honesty. Our better natures repudiate falsehood wherever we find it. No less should it be repudiated in art industry than anywhere else.; yet nowhere else has it been more prevalent. To all kinds of expedients resort has been made to gain effect—in furniture drawer-fronts that have no drawers behind them; doors that open nowhere, or, perhaps, do not open at all; handles that have no use; wood that professes to be one thing and is really another. The most illiterate and unskillful falsehood that I ever saw in furniture may be seen in a bureau which I have in my possession. It is veneered with mahogany, and the grain of the veneering runs up and down, or crosswise of the drawer, the drawer being about eight inches wide and three feet long. No sane cabinetmaker would ever think of cutting out a solid drawer-front in that manner; it would probably break before he got it together. And yet that bureau has been standing twenty-five or thirty years, persistently contradicting one's idea of good construction. In the construction of our houses we are likely to find the same pernicious falsehoods—brackets that support nothing; columns and pilasters that have no weight above them, or, the converse, absence of a column or pilaster where there ought to be one; windows that light nothing, or, as I have seen them in Kansas City, allowing the sun to shine through them from the street to light up the roof behind them. These are a few of the falsehoods perpetrated in industrial art.

3d—Color. Color, as applied in the industries, is natural and artificial. Natural color is the color of the material, such as walnut, pine, stone, brass, and

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* Read before the Kansas City Academy of Science, January 27th, 1880.

gold. Artificial colors are obtained by the use of pigments. The civilization of to-day is not an adept in the use of color. Scientists have studied it as a phenomenon of physics, and can demonstrate to an atom the proportion of colors necessary to complete harmony; but in practice the imperfections of pigments will baffle them.

The use of color seems to be an institution whose proper development has been dwarfed by the monopolizing character of other matters in the processes of civilization, and, if we would learn in this respect, we must sit at the feet of the barbarian in those countries where nature has so lavishly bestowed her hues for his education. The great difficulty in the way of our education in this respect lies in the unwillingness of the average civilized man to be taught by the barbarian. He imagines that general culture and advancement mean, necessarily, superiority in all things, and does not realize that in some respects the barbarian may be more civilized than he. Upon this point I quote from Lady Varney, in the *Contemporary Review:*

"The Hindu arranges colors for a fabric with the same certainties of intuition that a bird weaves its nest or a spider its web. His blues and greens are as harmonious in their combinations as those of nature herself, while the educated Englishman is introducing every species of atrocity wherever he goes, ruining the beautiful native manufactures by instructions from his "superior" standpoint, forcing the workers to commit every blunder which he does himself at home, in order to adapt their fabrics to the abominable tastes of the middle classes of England. Even the missionaries, male and female, cannot hold their hands, but teach their children, in schools and harems, crochet and cross-stich of the worst designs and patterns, instead of the exquisite native embroideries of the past. Arsenic greens, magenta and gas-tar dies are introduced, by order of the merchant, into carpets and Cashmere shawls. Vile colors and forms in pottery, and bad lacquer-work, are growing up by command in China and Japan. There seems to be no check or stay to the irruption of bad taste which is swamping the whole world by our influence."

4th—Among the abstruse elements of excellence is Form, or Proportion. The form of any manufactured article is largely dependent upon its use and the nature of the materials at command. In practice it is oftentimes closely allied to economy of material. For example, the panel is more economical and more beautiful than the solid; the column is more economical and more beautiful than the pier.

But there are, aside from the matter of economy, certain laws of proportion which define to us the conditions of good propoition. For instance, the proportion of two to five is better than that of two to four; of three to eight, better than that of three to six, or three to nine. In other words, a subtle proportion is better than one that is easily apprehended. But, in industrial art, where proportions must of necessity be within certain limits, it must be left almost entirely to the artisan to produce the best results obtainable within those limits. Consequently, an intuition for proportion is more important than a knowledge of the law, and we

must cultivate this intuition in the same manner that we would cultivate intuition for color, by a close observance of nature and the precept of a good example.

We have now counted some of the requisites of the abstruse elements of excellence. There are others, but it is not necessary to consider them here. We may sum them all as follows: Good art in any product of industry is the evidence of intellectual sagacity and genuine æsthetic feeling upon the part of the artisan.

I quote again from a casual writer in the *American Architect:*

"Artistic decoration is supposed to have a two-fold duty to perform: first, to decorate, and then, to tell a story, the first is to give richness in effect to the structure, space or fabric, which would otherwise be simple, plain or crude. Plastic decoration (color decoration too) becomes an art only when it becomes expressive of an idea, when it is crystallized thought, when you can read it like a book, whether it represents animate or inanimate nature. A large building decorated artistically will give indefinite pleasure to a cultivated mind. The more one looks at it the more one finds in it to admire. One cannot take it all in at once, while a building decorated until one cannot rest with gold and ornaments, containing no idea, receives but one glance, is called 'magnificent,' and let go. One glance is enough. Whenever you look at it again your mind says at once: 'Oh! I've seen that before.'"

In each succeeding instance, very nearly the same identical conditions were to be filled and the same means of filling them were at hand. So the architect, instead of branching out into new fields of investigation, new methods of construction, was content to put his columns and pilasters just where his ancestors put them, seeking only to enhance their beauty and give, by one method and another, added grace to the form of the structure, touching up the leaf of a capital here, deepening the shade of a molding there, little by little, and with conscientious care, seeking to make more valuable the legacy which his fathers left him.

Thus was perfected that purity and beauty of style which has been the model and the marvel of ages. The best results of Roman architecture were attained by the same slow methods. But, after a while, Greece and Rome lost their prestige, the world banished the old mythologies, and the Christian religion became paramount. New structures for new purposes became necessary, and they were to be erected in other countries, by the use of other materials and other methods, and under different conditions of society. And so arose Gothic architecture and Gothic art.

But the first changes from the old forms and methods were faint and imbecile, marking the efforts of a people trying to accomplish something, not understanding clearly what.

Groping blindly after the light and slowly finding it; stepping boldly to an experiment in this direction, and timidly projecting one in another; retaining the successful, rejecting the unsuccessful; slowly casting aside the cumbersome and useless features of the old, slowly adding on the new. No one man

invented the style; it was the work of a multitude. Each architect held in hand as it were the experience of his predecessors, and adjusted them to the requirements of the problem at hand; raising an arch a little here, clustering columns together there, meeting the thrust of that vault with a buttress, gradually massing the walls into piers, filling the spaces between with windows, after a while grouping these windows, changing them to suit the different requirements of light, of construction and of beauty, and thus passing on from one step to another until the highest excellence was reached.

Thus were developed the Grecian and Gothic styles of architecture and contemporary with and in harmony with them the entire train of industrial arts. Growing as grows the tree from the seed, at first feeble and uncouth pulling its way out of the ground, and gradually, year after year, unfolding its excellence to the sunlight, and at last in the fullness of life giving out the blossom and the fruit. The blossom and the fruit exhibiting withal an individuality in harmony with and partaking of the nature of the first shoot that came from the ground.

Not only did Grecian and Gothic art attain their excellencies by the above processes, but no worthy manifestation of industrial art ever existed that was not produced in similar manner.

Now to bring the application of these remarks down to our own time and our own country, we want to know wherein this question is one of concern to us as a nation and as a community. Properly understood, the value of art work to any country—especially as applied to the industries—can not be questioned. The part which it plays in the political economy of a nation is an important one. It is a historical fact throughout all time that those peoples who have exhibited the greatest advancement in industrial art have been able to command the markets of the world. It has been theirs to choose, and it has fallen upon their neighbors to pay for the choosing.

To-day the staples of our markets are wheat and beef, and it is true that wheat and beef are splendid things to have for sale where the world is hungry. People will eat and he who has food to sell rarely fails to find a market for his commodity. But when the world is fed it has no use for bread and meat, and the country that depends solely upon the sale of these things for a livelihood is subject to the caprice of the markets. To-day they may sell at a profit of 100 per cent, to-morrow at a loss of 50 per cent. But the people that is skilled in the industries, that moreover can send its products abroad stamped with a name which the consumer knows to be synonymous with excellence in *all* of its attributes has in its hands the source of wealth unbounded.

We all know how France has for so many years held the prestige of the world in this respect; how French goods have found ready sale and high prices in every market, and we have seen with that wonderful elasticity the French people arose from the disasters of a great war. How easily they paid off that immense indemnity, and all because the French people have right in their hands the true sources of wealth. They have not in their work discarded any elements of

excellence. They have realized and felt that the world demands and will pay for those impalpable attributes which satisfy longings of an æsthetic nature.

The wealth flowing into the coffers of this people has been one of the objective results of this policy. The subjective results are no less marked. They have settled from the top to the bottom of society, permeating every industry, even to the tilling of the ground. No country is better tilled than France, raises more food to the acre or food of such excellent quality. So of the other industries. The man who grows up in an atmosphere which favors the growth of all excellence for mere excellence' sake, you may be sure that whatever vocation he may adopt he will be in it an adept so far as in him lies.

To this is due whatever of mental and material prosperity France enjoys to-day. It has made her prosperous in spite of her frailties, which we know are grievous. There is but one thing lacking in French art, and that is moral stamina. How this affects art industry I hope at some future time to discuss. So much at present with France.

America stands, it seems to me, pre-eminently fitted to take up this work of art industry and carry it through to the highest consummation. She has, as a foundation, a peculiarly rich development in mechanical science. She is enough removed from the old world to be untrammeled by its traditions, yet near enough to study and assimilate the experience of the ages. We have with us, I think, enough native art feeling to work out a style avowedly American, yet no less worthy than those great styles which have given tone to all the art work of Europe. And the work has already begun. A style, an offshoot of Gothic art has taken root amongst us. Its examples, many of them crude and unskillful, are to be found in houses and furniture in various parts of the land.

The best instances are found in the older and wealthier cities. They mark the beginning of a new era in American industry. Beginning, I say, and not the ending, for the end is a long way off. Rapid advancement, it is true, has been been made in the past ten years but not all of it has been true advancement. It is a struggle all the way through ignorance and fallacy upon one hand, intelligence and truth upon the other. There are besetting sins into which votaries of art have at all times been liable to fall and the American disciples are no exception to the rule. Real progress is arduous. There is the old adage, "No excellence without great labor." It is just as true in the province of art as anywhere. The process brings to mind the words of the poet Boker:

"Silently sat the artist alone,
Carving a Christ from the ivory bone,
Little by little with toil and with pain;
He won his way through the sightless grain,
That held and yet hid the thing he sought."

True art growth is not the caprice of fashion. It is the thought, life and feelings of a people wrought into its industries. It is the evidence of an attempt upon the part of a people to bring out from the inanimate forms of wood and stone, of brass and iron, expressed aspiration for nobler and better things.

So what our art shall be, it is for us as a people to decide, whether it sh be trivial, commonplace and meaningless, or earnest, living and progressive. what we have done in other lines of thought and investigation is an earnes what we are to do in this, a good result is assured.

Here in the west we, perhaps, have some difficulties to encounter which a not found farther east, the most notable being, the engrossing character of rapid development of commerce and the natural resources of the coun It has been said that new countries are not favorable to the growth of art. "S ciety is too crude and uncultured to properly appreciate it." We don't ple guilty unconditionally to this charge, and I imagine that if we would only av ourselves of the means of education at our command, encourage the good a depreciate the bad, from whatever source they came, the result would be a prope appreciation of excellence from its æsthetic and utilitarian aspects, productive o much good to our commonwealth.

GEOLOGY.

SOME OBJECTIONS TO MODERN GEOLOGICAL TEACHINGS.

BY J. A. SMITH, PAOLA, KANSAS.

There are some things, in the accepted history of the earth's crust, that do not, in our opinion, agree with the first chapter of Genesis. Our purpose is no to assail the Bible; on the contrary, we hold that any statements or theories which do not harmonize with the general teachings of the Bible, are false. What we particularly object to is the construction put upon the word "day" in our text-books and standard works on geology. And we wish these objections to be regarded rather as inquiries after truth, than attacks upon any of the establishe principles of the day.

To begin at once, we quote from Dana's Manual, page 768: "Objections are often made to the word 'day'—as if its use limited the time of each of the si periods to a day of twenty-four hours. But, in the course of the documen (Scriptures) this word day has various significations, and, among them, all that are common to it in ordinary language. * * * * * The proper meaning of 'evening and morning,' in a history of creation, is *beginning and completion*; and in this sense, darkness before light is but a common metaphor.

"A Deity working in creation, like a day-laborer, by earth-days of twenty-four hours, resting at night, is a belittling conception, and one probably never in the mind of the sacred penman. In the plan of an infinite God, centuries are re-quired for the maturing of some of the plants with which the earth is adorned."

On page 769 the same author says: "Each of these eras opens with the ap-

pearance of *light;* the *first*, light cosmical; the second, light from the sun, for the special uses of the earth."

We believe these principles are generally accepted among geologists.

The first objection is based on the well-known physical law that vegetation cannot germinate, grow, mature and reproduce its kind without the influence of sun-light. But according to Genesis, vegetable life made its appearance on the third day, and the sun on the fourth. If these days were periods of years, as the geologist claims, he must admit one of two things—that the sun lighted the earth at this time, or that vegetation grew in darkness. The latter position is unphilosophical; and if he takes the former he has no reason for assuming that the light spoken of in the third, fourth and fifth verses of the first chapter of Genesis is cosmical. These verses read:

"And God said, Let there be light: and there was light.

"And God saw the light, that it was good: and God divided the light from the darkness.

"And God called the light day, and the darkness he called night: and the evening and the morning were the first day."

Mark the language in the last verse. The *light* he called *day*, and the *darkness* he called *night*. This cannot mean anything but a literal day. And in the the following sentence, "the evening and the morning were the first day," the connection with the preceding thought is so close that it would be a far-fetched translation that would make the word "day" in one differ from the same word in the other. Again, in the fourteenth verse we have recorded:

"And God said, Let there be lights in the firmament of the Heaven, to divide the day from the night; and let them be for signs, and for seasons, and for days, and for years."

The conviction is irresistible, that these days divided from the darkness, or nights, by the solar light, are days of twenty-four hours. And to take the same word in the original and so contort its meaning as to make it agree with the geological theory of creation seems a little unsatisfactory.

"But," somebody is ready to say, "you are illogical in your reasoning. How can you regard the day mentioned in the fifth verse as being literal, and at the same time grant that the sun did not divide the day from the night until a later period, as mentioned in the 14th verse?" We grant no such a premise. That the sun had been in existence ages prior to this time, the merest tyro in science will hardly deny. And there is not the shadow of proof to show that the *light*, which was called *day* in the fifth verse, and the *day* of the 14th verse were anything more than *literal days*, as used in ordinary language. If the sun did not shine before the fourth day, then, of course, this argument falls to the ground.

In Exodus xx–8, is the command, "Remember the Sabbath-day to keep it holy," and in the 11th verse, "For in six days the Lord made Heaven and Earth, the sea and all that in them is, and rested the seventh day, wherefore the Lord blessed the Sabbath-day, and hallowed it." In this we are commanded to rest on

the seventh day; and our attention is called to the example of the Master who rested from the labor of the six day's creation. But if He labored six periods of years, and rested on the seventh period, we are perfectly justified in doing likewise.

Another objection presents itself, which will be better understood by first quoting from Dana, page 384: "At the close of each *period* of the Paleozoic age there was an extermination of a large number of living species. Again, as each *epoch* terminated, there was an extermination of life, but in most cases less general. With the transitions between strata of different kinds in the course of an epoch, there were usually some exterminations; and, even in the passage from layer to layer, there is often evidence of the extinction of some species. In a corresponding manner, there were often one or more new species with each new kind of layer, and generally several with each change in strata; while many appeared with the opening of an epoch, and a whole fauna, nearly, with the commencement of a period. Hence, the introduction and extinction of species were going on through the whole course of the history, instead of being confined to particular points of time; but at the close of long periods and epochs, there were more general exterminations."

On pages 487–8, the same author says: "No species of the European Cretaceous is known to occur in the Tertiary formation, and none of Asia or Eastern North America. In the Rocky Mountain region some Cretaceous species and genera continue on, if the coal series is Tertiary; and yet the number now known is less than half a dozen. The vast majority of the species, and nearly all the characteristic genera, disappear." In brief, Prof. Dana lays down the principle that at the close of each period there was almost universal extinction, followed in the next period by a new creation. This would lead to the following results:

1. A disappearance of early life.

2. A creation of fauna and flora now on the globe, of which geology affords no record.

Considering these facts, we are driven to the conclusion that the Mosaic account refers exclusively to the creation of 6,000 years ago. It cannot refer to two at the same time, since only one is mentioned. Or, if it does not refer to the creation of 6,000 years ago, it *must* refer to that of geology, and therefore we have no account of the manner or time in which present life came into existence.

Again, the record of the six days' work in Genesis, denotes *completion*. The 21st verse, for example, reads, "And God created great whales and every living creature that moveth, which the waters brought forth abundantly after their kind and every winged fowl after his kind." This was the fifth day. The verb will admit of no idea of continuance or progression. Life of the ocean and air was the result of one day's labor, and with that day the work ended. On the sixth day "God made the beast of the earth after his kind, and cattle after their kind, and everything that creepeth upon the earth after his kind."

It is a well-known fact that there are mammals now living on the globe, of

which geology has no knowledge; they appeared ages after the first protozoans began their movements in the sea; and even geologists themselves will hesitate before including the Silurian and Tertiary ages in one day of creation.

"In the beginning God created the heaven and the earth." This also implies completion, and it is the first announcement made in the divine record. After it came the creation of those things which dwell upon the earth, and move in the sea and in the air. It does not say that life came while the earth was building; to the contrary, the declaration that God created the heaven and the earth is a distinct, a clear and a definite statement, unmodified by anything that follows. It is not in our province to substitute a better theory in place of the one we are discussing. But if the first chapter of Genesis can be interpreted literally, leaving the geological work of creation to precede the six day's work of the Creator, or to be included in the labor of the first day, we think that the Bible and geology will harmonize more fully than they do at the present time.

THE ATTRACTIONS OF THE YELLOWSTONE NATIONAL PARK.

The Yellowstone Park embraces an area of fiftv-five by sixty-five miles, and contains the most striking of all the mountains, gorges, falls, rivers and lakes in the whole Yellowstone region. The hot springs on Gardiner's River, for example, are along its northern boundary; the Grand Cañon lies toward its northeastern corner; toward its southeastern corner stretches Yellowstone Lake, and occupying the western central portion is the wonderful Geyserland.

"This whole region," says Dr. Hayden, the United States geologist, "was, in comparatively modern geological times, the scene of the most wonderful volcanic activity of any portion of our country. The hot springs and geysers represent the last stages—the vents or escape pipes—of these remarkable volcanic manifestations of the internal forces. All these springs are adorned with decorations more beautiful than human art ever conceived, and which have required thousands of years for the cunning hand of Nature to form."

Entering the Park by the Virginia City wagon road, the visitor first encounters the geysers. These rival the most famous of Iceland, and deserve detailed description. The explorer—Lieutenant Barlow—tells us that near the edge of the basin, where the river makes a sharp bend to the southeast, is found the initial geyser—a small stream vent—on the right. Soon on either side of the river are seen two lively geysers called the "Sentinels," because of their nearness to the gate of the great geyser basins. The one on the left is in constant agitation, the waters revolving horizontally with great violence, and occasionally spouting upward to the height of 20 feet, the lateral direction being 50 feet. Enormous masses of steam are ejected. The crater of this is 3 feet by 10. The opposite sentinel is not so constantly active, and is smaller. About 250 yards from the gate are three geysers acting in concert. When in full action the display from these is very fine. The waters spread out in the shape of a fan, in consequence of which they have

been named the [illegible] Geysers. One hundred yards farther up the side of the stream is found a double geyser, a stream from one of its orifices playing to the height of 80 or 90 feet, emitting large volumes of steam. From the formation of its crater it was named the Well Geyser.

Still above are found some of the most interesting and beautiful geysers of the whole basin. First are two smaller geysers near a large spring of blue water, while a few yards beyond are seen the walls and arches of the Grotto. This is an exceedingly intricate formation 8 feet in height and 90 in circumference. It is by many called the gem of all the geysers. It is absolutely magnificent—a sight of resplendent beauty that greets the eyes nowhere outside of the region of the National Park. It is simply a miniature temple of alabaster whiteness, with arches leading to some interior Holy of Holies, whose sacred places may never be profaned by eye or foot. The hard calcareous formation about it is smooth, and bright as a clean swept pavement. Several columns of purest white rise to a height of 8 or 10 feet, supporting a roof that covers the entire vent, forming fantastic arches and entrances out of which the water is ejected during an eruption 50 or 60 feet. The entire surface is composed of the most delicate bead work imaginable, white as the driven snow, massive but elaborately elegant, and so peerlessly beautiful that the hand of desecration has not been laid upon it, and it stands without flaw or break in all its primal beauty—a grotto of pearls, "the beautiful princess of all the realm."

FAN GEYSER.

Proceeding 150 yards farther, and passing two hot springs, a remarkable group of geysers is discovered. One of these has a huge crater five feet in diameter, shaped something like the base of a horn—one side broken down—the highest point being fifteen feet above the mound on which it stands. This proved to be a tremendous geyser, which has been called the Giant. It throws a column of water the size of the opening to the measured altitude of 130 feet, and continues the display for an hour and a half. The amount of water discharged is immense, almost equal in quantity to that in the river, the volume of which during the eruption is doubled. But one eruption of this geyser was observed. Another large crater close by has several orifices, and with ten small jets surrounding it, formed probably, one connecting system. The hill built up by this group covers an acre of ground, and is 30 feet in height.

Wonderful hot springs burst out at many different points in the Park, but those in the northern portion are most generally admired. The springs in active operation on Gardiner's River cover an area of about one square mile, and three or four square miles thereabouts are occupied by the remains of springs which have ceased to flow. Small streams flow down the sides of Snowy Mountain in channels lined with oxide of iron of the most delicate tints of red; others show exquisite shades of yellow, from a deep, bright sulphur to a dainty cream color; still others are stained with shades of green—all these colors as "brilliant as the brightest aniline dyes," declares one observer. The water, after rising from the spring basin flows down the sides of the declivity, step by step, from one reservoir to another, at each one of them losing a portion of its heat, until it becomes as cool as spring water. The natural basins into which these springs flow are from four to six feet in diameter, and from one to four feet in depth. The principal ones are located upon terraces midway up the sides of the mountain. "The largest living spring is near the outer margin of the main terrace. Its dimensions are 20 feet by 40 and its water so perfectly transparent that one can look down into the beautiful ultramarine depths to the very bottom of the basin. Its sides are ornamented with coral like forms of a great variety of shades, from a pure white to a bright cream yellow, while the blue sky reflected in the transparent water gives an azure tint to the whole which surpasses all art."

But the brightest jewel of our wonderful park—Yellowstone lake—must no longer pass unnoticed. It is about 20 miles long and 15 miles broad, with a rough and irregular, but almost enchanting shore line. Its superficial area is about 300 square miles, its greatest depth 300 feet, and its elevation above the sea 7,427 feet. Lying upon the very crown of the continent, Yellowstone Lake receives no tributaries of any considerable size, its clear, cold water coming solely from the snows that fall on the lofty mountain ranges that hem it in on every side. Of this the enthusiastic Langford says: "Secluded amid the loftiest peaks of the Rocky mountains, possessing strange peculiarities of form and beauty, this watery solitude is one of the most attractive objects in the world. Its southern shore, indented with long, narrow inlets, not unlike the frequent fiords of Iceland, bears

[illegible] LANE.

estimony to the awful upheaval and tremendous force of the elements which resulted in its erection. The long pine crowned promontories stretching into it from the base of the hills, lend new and charming features to an aquatic scene full of novelty and splendor. Islands of emerald hue dot its surface, and a margin of sparkling sand forms its setting. The winds, compressed in their passage through the mountain gorges, lash it into a sea as terrible as the fretted ocean, covering it with foam. But now it lay before us calm and unruffled, save as the gentle wavelets broke in murmurs along the shore. Water, one of the grandest elements of scenery, never seemed so beautiful before."

Besides its entrancing shore line the lake is dotted with numerous islands, which lend rare beauty by their luxuriant vegetation. Fish abound in the lake, game of all kinds inhabits the surrounding forests, and the placid surface of the water and grassy margins render this mountain-locked sheet the earthly paradise for myriads of water fowl. There are facilities for boating here, and rather primitive summer accommodations for the tourist.

It is but a pleasant two hours' ride from the lake to the falls. The head of Yellowstone Cañon is but a short distance above the Upper Falls, and just before reaching them narrows down to a close gorge, compressing the waters into so small a passage-way that they drive through with great commotion. The first fall is only a quarter to a half a mile above the lower one, and the stream dashes over a perpendicular cliff 140 feet high. "The river is now dashed into a turbulent, foamy cascade, by its ragged bed and lightning speed, and does not again become smooth until just the instant it takes its dizzying leap of *three hundred and ninety feet* perpendicularly to its narrow bed in the depths of the great cañon. On either side of the falls, and so far as the eye can see below, there rises to a height of two thousand feet above the river, a grand, vast wall of infinite masonry, so gorgeously colored and tinted, so bounteously beautified in gilt, purple and carmine, that no oil painting, however fine, will ever do justice to the natural picture! There is no painful glare of one color prominent over another; the Great Artist has used each brush deftly, and with his divinely exquisite touches each tint and shade is so perfectly blended that the mighty walls seem as if built by the equal commingling of all the precious metals of the world!"

The Great Falls of the Yellowstone, with their symmetrical proportions, containing "all the elements of picturesque beauty," and so intimately connected with all the strangely-fascinating enchantments of the delicately-carved and gorgeously-crowned Grand Cañon, excel in sublimity the world known Niagara, or the soul-inspiring Yosemite. As a friend, who is given to "cold figures" and poetry at the same time, says: "The height of Niagara Falls—164 feet—is 226 feet less than our beautiful falls of the National Park. The sheet at Niagara is 1,100 feet in breadth, while that of the Yellowstone is less than 200. The discordant roar of Niagara is liquid music at Yellowstone; the majesty of the former is poetry at the latter. The waters which dash over Niagara flow through a level and monotonous region, and have a weary, business-like appearance; while the

Yellowstone, gliding through a region sublime in scenery and associations everywhere, falls into the grandest canyon of the world. The former are 300 feet above sea level, the latter 8,000! The great suspension bridge is but 258 feet above the water; a like bridge across this great cañon would rise *two thousand feet* above the little stream."

The view of the Grand Canyon from the heights above, is pronounced by a widely known traveler "The finest piece of scenery in the known world," and indeed it is hard to conceive of any combination of pictorial splendors which could unite so potently the two requisites of majesty and beauty. Twenty miles long it is impassable, and inaccessible at the water's edge, except at a few points. Its rugged edges are from two hundred to five hundred yards apart, and its depth is so profound that no sound ever reaches the ear from the bottom. "The stillness is horrible. Down, down, down, we see the river, attenuated to a thread, tossing its miniature waves, and dashing, with puny strength, against the massive walls which imprison it. All access to its margin is denied, and the dark gray rocks hold it in dismal shadow. Even the voice of its waters in their convulsive agony cannot be heard. Uncheered by plant or shrub, obstructed with massive boulders and by jutting points, it rushes madly on its solitary course. The solemn grandeur of the scene surpasses description. The sense of danger with which it impresses you is harrowing in the extreme."—*Resources of Montana.*

ENGINEERING.

OBJECTIONS TO DE LESSEP'S CANAL.

The countries interested commercially in establishing a water communication across the isthmus, are the United States and Great Britain. Neither of these countries believe that their commerce would be materially benefited by a canal across the isthmus at Panama. It was long ago stated by Com. Maury, the best authority on ocean winds and currents, that if by some convulsion of nature a navigable strait were opened there, it could never become a channel of commerce. It lies in the region of equatorial calms, and passage through it would be impracticable for sailing vessels. On the gulf side the northeastern trade winds blow directly against the coast, and a sailing vessel can not get away to the eastward. On the Pacific side the calm belt extends up to San Juan, and vessels leaving Panama are becalmed for weeks. If there were a passage through the isthmus, he said that sailing vessels would still save time by the much longer route around Cape Horn. This, he remarked, is the reason why so little use is made of the Panama railroad. Non-commercial people are not aware of the magnitude of the trade in sailing vessels around Cape Horn. One

thousand vessels laden with wheat voyaged from California to England last year, and this single item is not very large compared with the aggregate. Two great commercial nations like the United States and Great Britain will hardly be guilty of the folly of building a canal without being assured of its accessibility to the class of vessels relied on for cheap transportation.

This apparently insuperable objection does not apply to the Nicaragua route. Besides, this route has the advantage of greatly shortening the length of the voyage between the eastern and western shores of the United States, which fact alone makes it a favorite in this country. It is also the favorite route in England, chiefly for the reasons given by Commodore Maury. It is not likely, therefore, that M. De Lesseps will succeed in obtaining much aid for his Panama canal in either of the two countries most interested in a water communication between the waters of the Gulf and the Pacific.—*Globe-Democrat.*

ASPHALT FOR STREETS AND ROADS.

W. H. DELANO, C. E.

Adopting the nomenclature of M. Léon Malo, which had received general sanction, the author considered asphalt as a combination of carbonate of lime and mineral bitumen produced by natural agency. Asphaltic mastic was the rock ground to powder, and mixed with a certain proportion of bitumen. Gritted asphalt mastic was asphalt mastic to which clean sharp sand had been added. Asphaltic or bituminous concrete was gritted asphalt mastic mixed when hot with dry flint or other stone. Boussingault's analysis of bitumen gave C 85, H 12, O 3. It was, therefore, an oxygenated hydro-carburet, and quite distinct from the preparations of gas-tar and pitch which were sometimes erroneously styled bitumens and asphalts. Powdered limestone should be white, and soft to the touch; if rough, it probably contained iron pyrites, silicates, crystals, etc. The presence of these substances was prejudicial, and if suspected, the limestones should be subjected to secondary analysis, directions for which were given. The proportion of bitumen to limestone in the natural asphalt should not exceed 10 per cent. for carriage-ways, indeed, less than that was preferable. For this latter purpose no asphalt should be specified which had not stood the test of at least three hot summers and three cold winters. These precautions being taken, the author was of the opinion that a well laid surface of compressed asphalt, 2 to 2⅝ inches thick, on a foundation of Portland cement concrete, 6 to 9 inches thick, was superior to all other carriage-ways. It was noiseless; hygienic, being impervious to urine and the liquids from dung; absorbed vibration; produced neither dust nor mud; was cheap, durable, and easily repaired, and the old material could be used again. The charge of slipperiness, which has been made against asphalt roadways in London, was not due to the material, but to the absence of provision for proper scavenging. In Paris, where the asphalt

was regularly scraped, washed, and swept, the complaint did not arise. In support of the assertion that climate did not affect the asphalt in London, a table of humidity was given, showing the means of six years (1873–8) observations to be —for Paris, 80.2; for London, 81.5. The cost of washing the roadways, when done systematically, and on a large scale, was much less than was generally supposed, and the advantages far more than counterbalanced the expense. In Paris, this compressed asphalt carriageways cost on the average, about 13s. per square yard on lime concrete 4 inches thick, but a thickness of 6 inches to 9 inches of Portland cement concrete was much preferable.—*Iron.*

OBJECTIONS TO CAPT. EADS' SHIP RAILROAD.

The Boston *Journal of Commerce* says: "Capt. Eads is at present before Congress urging a guarantee on $50,000,000, at the rate of 6 per cent. per annum, in order to give him the backbone to construct a railroad across the isthmus of Darien. He proposes to lift ships out of the water and drag them across the isthmus upon some kind of a railroad. The fallacy and absurdity of this, in an engineering point of view, has been very fairly shown by the recent experiment upon one of the New York packets. The steamer Nevada, of the State line, in coming into port ran ashore at Sandy Hook. Some difference of opinion between the officers and agents existed as to the damage which might or did exist. In order to settle it and know what repairs should be done, she was sent directly to the dock with a full cargo of pig iron on board. After getting her on the dock it was impossible to raise her on account of the weight of iron in the hold. The iron was discharged and put on canal boats alongside the dock. Shipmasters condemned the whole proceeding, saying that it must necessarily strain her and throw her out of line. The *American Ship*, in speaking of this, puts the very pertinent query: "If the attempt to lift a loaded ship out of the water, supported as she would be on her dock, without horizontally moving her plane of support, meets with condemnation at the hands of shipmasters and men capable of judging from experience, what must be that of the proposed project of Capt. Eads, not only of lifting out of water, but of transporting these large vessels, steamers, or others loaded with their cargoes across the isthmus."

THE SAINT GOTHARD TUNNEL.

The meeting of the two headings took place at nine o'clock on the morning of the 29th of February. An immense amount of work still remains to be done before the tunnel will be ready for traffic, but this will doubtless be done before the close of the present year.

The idea of tunneling the Saint-Gothard grew out of the successful completion of the famous Mont Cenis tunnel, which put an end to the profitable

monopoly hitherto enjoyed by the great Swiss highways, in the transfer of passengers and merchandise between Italy, Switzerland, France and Germany. To open a new and direct railway route across the Alps, several projects were presented; but the Saint-Gothard line was finally selected as the best, chiefly for reasons of a political character. In 1871, the government of Italy, Switzerland and Germany concluded a treaty relative to its construction, location, etc., etc., agreeing to contribute the sum of 85,000,000 francs therefor, to be assigned as follows: Italy 45,000,000 francs, and Switzerland and Germany, each, 20,000,000 francs. A railway company was organized from a confederation of Swiss and Italian roads, and the contract for the work was awarded on the 7th of August, 1872, to M. Louis Favre. One of the conditions of the contract was, that the perforation should be completed within eight years from the date of signing, with a liberal premium (1000 francs per day) in case of completion at an earlier day, and an equivalent penalty in case of delay. As will be seen, M. Favre's estimate of his ability to complete the task within the time prescribed has been fully justified by the event, and that in spite of the fact that difficulties and delays of a most serious nature were met with, from the caving in of the rock and the irruption of water. This work has been accomplished in less time by five years than it required to pierce the Mont Cenis tunnel, which, up to the present achievement, was the longest tunnel in the world. This rapid work is to be ascribed to the great improvements made in the machinery and methods for drilling and tunneling, rather than to superior engineering skill, though this was of the highest order.

The line of the tunnel commences at Airolo, passes northwest under the Kastelhorn (2977 meters high), the St. Anna Glacier, the village of Andermatt, the river Reuss about at the Devil's Bridge, and emerges at Goeschenen, at the level of that village. The station at Airolo is 1145m. above the sea, the summit level is 1152.4m, and the Goeschenen level, 1109m. The cross section of the tunnel is the same as that of Mont Cenis. The total length of the tunnel proper is 14,920 meters.

When the tunnel is opened for traffic, with its railway connections completed, it will afford the shortest line of transit between the Mediterranean and the Rhine; and, considered in connection with the political and commercial relations of the nations whose interest it is intended to subserve, it may justly be regarded as the most important engineering work on the continent of Europe.—*Engineering and Mining Journal.*

The reclamation of arid lands by means of artesian wells has lately been seriously proposed and advocated in Congress. It is stated that there are no less than 900,000,000 acres of arid lands, situated chiefly in Arizona, Dakota, Idaho, Montana, New Mexico Utah, Wyoming, Colorado and Nevada, of which less than 1 per cent. has been sold by the government, and which must

remain practically a desert, unless some method is found to supply them w water. Of the above total of 900,000,000 acres, it is estimated that about ... 000,000, consisting of plain and valley land, only lacks this vivifying eleme... become susceptible of high cultivation; and of which not more than 3 per c... can be reclaimed by the intelligent utilization of the existing rivers and s... streams for irrigation. The remainder is of little value. Under these cir... stances, the government has been urged to appropriate the sum of $50,000, ... the purpose of sinking experimental artesian wells for the purposes of irriga... Should the result demonstrate the utility of this experiment, it is held that ... will be plenty of private capital forthcoming to continue and extend the work.

MEDICINE AND HYGIENE.

WINDOW GARDENING IN SMALL HOUSES.

BY MRS. M. W. HUDSON.

This is not a dissertation on the Aphis, nor a treatise on the ingredients ... the soil and the proper humidity of the atmosphere, but a protest against giv... the sunniest, and perhaps the only southern window in the house, to plants ... winter.

The poetical idea that plants in the house have a refining influence, leads many women to keep "just a few," though her rooms are small and cold, fue... scarce and expensive, her windows few and her children sometimes many, and always dear.

Once having potted and brought her plants in, she actually forms an attachment for them or she would not tolerate the starved and half frozen things before her eyes for months. A polite way of accounting for the fact that a woman who really appreciates flowers can cherish the sickly and straggling plants that obscure so many windows in winter, would be to say that it is one of the mysteries of the feminine mind. It must be. Probably, also, it is the same mystery that blinds women to the fact that children in the background of a little window religiously curtained as to the upper half and devoted to flower pots and a bird cage below, have complexions like the inmates of a lunatic asylum or a "Shepherd's Fold."

A dozen times a day they are told: "Don't go near the window, children, you will upset the plants." At night the pots must all be lifted to the warmest corner, very often at the expense of a grudging word from her liege lord, who does not, however, give any good reason why he thinks them nuisances, and is inclined, notwithstanding his complaints, to humor his wife in the matter of a few plants if they afford her any pleasure, and she declares they do. Occa-

sionally, to be sure, window plants in small houses are so well taken care of that they thrive and bloom and gladden all the household, but any housekeeper must know that they are nearly always matured by the exclusion of fresh air and the sacrifice of sunshine.

In small houses the ventilation for night, as well as day, must frequently be secured through the living room, and if plants have to be saved from freezing by keeping every crack in the windows closed, the sleepers must suffer. The common belief that plants in a sleeping room are injurious to health is unauthenticated in practical experience, except for this reason. The deleterious gases a few plants will exhale in a night have an insignificant effect on the human system compared with the influence of repeatedly breathed air, but the cheering effect of a few unseasonable flowers will not compensate for the lack of sunshine in the house.

Baby's playhouse should be just under the window where the flower stand is it will do him quite as much good to flatten his little nose against the glass and revel in the sunshine as it will do the bursting buds to drink it all day long. And when baby's mother sits down to sew and read, it will do her more good than all other tonics can to sit in the full glow of the vivifying sunlight.

Shaded rooms depress the spirits and benumb the mind as well as the body. It is a sanitary wrong that no intelligent wife and mother will be guilty of, to darken the windows and keep her family in perpetual gloom. The sunniest rooms in the house should be the living rooms, and the people in the house should have the benefit of the first seats before the shrine of light; not even heliotropes and roses should intervene. Homes that have enough windows to supply both the human inmates and plants with light and air, are of course not referred to here, and the woman who has time and space for the cultivation of flowers would not be of the nature that men love if she did not have them the year round, but since such a large proportion of western people live in small houses, few of them are sufficiently well lighted, and since window gardening in winter is becoming more general each year, because it is so constantly urged by seedsmen and florists as one of the things women should do, it seems time that some one entered a plea for the babies' rights.

RELATIVE DANGER OF ANÆSTHETICS.

BY DR. WIGHTMAN A. DROWNE, KANSAS CITY, MO.

The power of various substances to produce insensibility has long been known, and in all ages certain narcotic preparations have been employed to produce a more or less unconscious state so as to lull the pain during the performance of painful operations. It is needless to enumerate all the different anæsthetics employed. But what seems to interest us the most on the subject in the present day, is the vexed question: "What substance have we that affords the

most safety to the patient?" No complete anæsthetic is perfectly safe, as the following statistics, which were proved by the late Prof. Morgan, of Dublin, to be correct, shows; the relative fatality of each being as follows:

Ether	1 in 23,204.
Chloroform	1 in 2,873.
Mixture of chloroform and ether	1 in 5,558.
Betchloride of Methyline	1 in 5,000

Nitrous oxide, (gas), not given. We also learn from this table two facts, viz: That chloroform is the most dangerous anæsthetic (given in the table) that could be used; that ether is about eight times safer, and proved by the same table to be the safest of all anæsthetics used. As regards nitrous oxide, few practitioners cannot but be aware of the startling fact, that occasionally, in the columns of the various publications, their attention is arrested by a paragraph, headed, "A Death from Gas," and, taking into consideration the number of deaths attributable to its use, that are never recorded, which occur in private practice, a high percentage of mortality, must of necessity, exist. And notwithstanding these facts I noticed but recently, an advertisment, stating that nitrous oxide administered by the advertiser was absolutely free from danger. I am well aware that the theory has been that it was perfectly safe, but old and deeply rooted errors do not fall at one blow, especially when they derive support from the extravagances of the opposition. The danger in the use of the nitrous oxide by inhalation, lies chiefly in the risk of an overdose being taken; as unconsciousness creeps on, the motor power is involved, and then the amount taken may be, and too often is, far beyond what was intended. Even practitioners of lengthened experience, who are wedded to the use of nitrous oxide, and who believe that there is no danger in it when properly administered, because they were fortunate enough never to be present at a fatal result during its administration, must have seen hair-breadth escapes, where the pulse suddenly became almost, or even quite imperceptible, the features became livid, the pupils were widely dilated, there was a state of general muscular rigidity; in short, all the phenomena of the first stage of an epileptic fit was present and the patient only recovered from the jaws of death by the use of artificial respiration, and other means, resorted to during those apprehensive moments; a time of the most painful anxiety to the practitioner, to say nothing about the delay in the operation, the apprehension of the attendants, friends, &c. Such consequences occur sufficiently often to allow all to be conversant with the fact that, no matter whether a stethoscopic examination of the heart reveals that organ to be free from organic disease or not, still there is danger. In the administration of this anæsthetic the practitioner often times fails to ascertain this for himself, but trusts to the mere statement of the patient. There is nothing more common than for a dyspeptic patient to say, "I never have a headache. I may eat and drink what I please, my stomach never troubles me." True, but his heart does; and careful examination would discover that his stomach is not so perfect as he represents it to be. It is precisely the same with a neuralgic patient with a decayed molar tooth. "You need not look there," he says.

"I never have the toothache," but he winces when we touch the tooth. I will make the assertion, that there is not a city in the country, but has confined invalids whose condition is attributable to the use of nitrous oxide. Patients have been known to leave the rooms of the practitioner, immediately after having been under its influence, apparently free from any injurious effects, but in a short space of time have become debilitated in their health, and ruined; and in many instances ignorant as to the cause of their condition. From all that has been written and said on the dangerous effects, my opinion is, that practitioners are not justified, without a very good reason, in using what has been proved to be a dangerous anæsthetic.

ARCHÆOLOGY.

PROCEEDINGS OF THE BOSTON SOCIETY OF NATURAL HISTORY, Dec. 3, 1879.

(EXTRACT.)

Mr. F. W. Putnam read an interesting account of his explorations of the ancient mounds and burial places in the Cumberland Valley, Tennessee. The excavations had been carried on by himself, assisted by Mr. Edwin Curtiss, for over two years, for the benefit of the Peabody Museum at Cambridge. During this time many mounds of various kinds had been thoroughly explored, and several thousand of the singular stone graves of the mound builders of Tennessee had been carefully opened. The material obtained from the explorations is now arranged on exhibition in the Peabody Museum. Mr. Putnam's remarks were illustrated by drawings of several hundred objects obtained from the graves and mounds, particularly to show the great variety of articles of pottery and several large and many unique forms of implements of chipped flint. He also exhibited and explained in detail a map of a walled town of this old nation. This town was situated on the Lindsley estate, in the bend of Spring creek. The earth embankment, with its accompanying ditch, encircled an area of about twelve acres. Within this enclosure there was one large mound with a flat top, fifteen feet high, one hundred and thirty feet long and ninety feet wide, which was found not to be a burial mound. Another mound near the large one, about fifty feet in diameter, and only a few feet high, contained sixty human skeletons, each in a carefully made stone grave, the graves being arranged in two rows, forming the four sides of a square, and in three layers. From these graves many interesting articles were obtained. The most important discovery he made within the enclosure was that of finding the remains of the houses of the people who lived in this old town. Of them about seventy were traced out, and located on the map by Prof. Buchanan, of Lebanon, who made the survey for Mr.

Putnam. Under the floors of hard clay which was in places much burnt, Mr. Putnam found the graves of children. As only the bodies of adults had been placed in one mound devoted to burial, and as nearly every site of a house he explored had from one to four graves of children under the clay floor, he was convinced that it was a regular custom to bury the children in that way. He also found that the children had been undoubtedly treated with affection, as in the small graves were found many of the best pieces of pottery he obtained, and also quantities of shell-beads, several large pearls, and many other objects which were probably the playthings of the little ones while living.*

Mr. Putnam also made a communication on the principles involved in the ornamentation of the pottery of some of the ancient nations of America, with particular reference to that from the Cumberland Valley in Tennessee, and from Nicaragua; illustrating his subject by a fine series of vessels of various shapes selected from the Peabody Museum of American Archæology and Ethnology.

After a general review of the methods of ornamentation employed by American nations of the past, he showed that, by a study of such large collections as those in the Peabody Museum, the artistic development of the ancient peoples of America was far greater than generally stated by writers; and that the art of ornamentation had, in many instances, risen above the simple patterns made by incised lines, rude stamps, and other early and crude forms. Both in color and plastic work, a realistic art had been produced which had often resulted in conventionalisms of great interest.

He also stated that a study of this ancient pottery, with these principles of conventionalism borne in mind, would not only place some of these ancient American nations in a much higher artistic period than formerly supposed, but would lead to the understanding of many of the singular ornaments on the ancient vessels, many of which, without this knowledge of the existence of realistic and conventional art, would be looked upon as crude and meaningless attempts at ornament, whereas, as he showed by several series of specimens, the simple knobs arranged symmetrically about a pot or water bottle, were instances of pure conventionalism from realistic forms, and prove that a comparatively high attainment in the decorative art had been reached.

A proper and careful study of the principles involved by this interpretation of the artistic developement of the ceramic art in America, he thought, would in time furnish means of making comparisons in regard to the probable connection of one ancient American nation with another, and also an understanding of many of the singular resemblances between widely separated peoples. Still, he said, the whole subject was yet in its infancy, and the connection of one ancient people with another in America, can at present only be suggested from very unsatisfactory data.

* A detailed account of this exploration with many illustrations will be found in the 11th report of the Peabody Museum, and in the 3rd volume of the Kansas City Review.

RAU'S PALENQUE TABLET.

PROF. O. T. MASON, COLUMBIA COLLEGE, WASHINGTON, D. C.

The last contribution to knowledge issued by the Smithsonian Institute, is No. 331 of its publications, a quarto of seventy-six pages, by Dr. Charles Rau, on the Palenque Tablet in the United States National Museum. The contents of the work are as follows: "Chapter I.—History of the Palenque Tablet; Chapter II.—Explorations of Palenque; Chapter III.—The Temple of the Cross; Chapter IV.—The Group of the Cross; Chapter V.—Aboriginal Writing in Mexico, Yucatan and Central America; Appendix.—Notes on the Ruins of Yucatan and Central America." In the first chapter we have a minute relation of the manner in which the tablet found its way from the Temple of the Cross to its present position in the National Museum. In the second chapter Dr. Rau gives a narration of various explorations of these interesting ruins. The name Palenques derived from a village about eight miles away, called Santo Domingo del Palenque. The ruins were discovered in 1750, by a party of Spaniards, and surveyed for the first time by order of Ramon de Ordonez in 1773–1784. The first exploration which led to any result was that of Capt Antonio del Rio in 1787; his manuscript was published in London, in 1822, with drawings from Castaneda, the artist of Dupaix. Capt. William Dupaix, in 1808, visited Palenque, with an artist named Castaneda. The MSS. and drawings will be found in Vols. IV, V, VI, of Kingsborough. Baron de Waldeck lived two years at Palenque, making surveys and sketches, 1832–4. His plates, with text by De Bourbourg, were published in Paris, in 1866, by the French Government.

When Dupaix visited Palenque the three slabs constituting the Group of the Cross were all in place. But at the time of Waldeck's visit, the right one, now called the Smithsonian Tablet, was in fragments on the floor; the middle one had been carried off to the banks of the river by a vandal who wished to adorn his house with it; and the one on the left was in its original position, which it now occupies. Stephens and Catherwood visited the spot in 1840, and were entertained by Mr. Charles Russel, our consul at Laguna. They made drawings of the ruins, and shortly after their visit the fragments of the right hand slab were sent to the National Institute in Washington, where it arrived in 1842. The site has since been visited by Arthur Morlet in 1846, and M. Dėsirė Charnay, for the French Government, in 1857. The tablet was transferred to the Smithsonian Institution 1858, and in 1863, while making a cast for Prof. Henry, Dr. George A. Matile discovered that this was the missing slab from the Palenque group, not drawn by explorers after Dupaix. It was broken again after Dr. Matile's cast was made, but reconstructed and set in its present frame, from which Dr. Rau's photograph was taken. Whatever doubt may have remained after Matile's argument, is now dispelled by reference to the outline plate of Dr. Rau's work, in which the whole Group of the Cross is again restored.

The occurrence of the sign of the cross in America anterior to its discovery by Columbus, has been the marvel of archæologists. But the fact of its appearance in many places where Christian influence had never been felt, compelled the student to look for other motives in its existence. The whole subject is reviewed in Chapter IV, pp. 39–46. Of equal interest with the allegorical sculpture is the subjects of the hieroglyphics, on which Dr. Rau has bestowed a great deal of faithful study. The supposed key to their interpretation is a MSS. found in the Royal Library of Madrid, by Brasseur de Bourbourg, in 1863, which is a copy of one composed by Diego de Landa, in 1579, and giving, among other things, an alphabet of thirty-three signs. It will be remembered that a similar old MSS. is mentioned by Sr. Orozcoy Berra, in Anales del Museo Nacional de Mexico, containing the Lord's Prayer in symbols, partly Aztec and partly ecclesiastic. All attempts to interpret the Central American glyphs and manuscripts by Landa's alphabet have proved failures. Dr. Rau, the most cautious of theorists, does not attempt a solution; but on page 61 gives a diagram of his outline plate, by which every glyph on the tablet may be easily referred to (it is a pity that the letters and figures do not occur on the margin of the plate itself). On pages 62 and 63, some of the glyphs are analyzed, and the places where the elements are to be found, are indicated. The author concludes that the analogies between Landa's signs and the glyphs warrant the suggestion that the inscriptions constitute a chronological record of some kind. On pages 53 and 64, Dr. Rau corrects an error of Humboldt, Kingsborough, Stephens and others, as to the close relationship between the Aztecs and ancient Mayas, based on the Dresden Codex, which is clearly shown to be of Maya and not of Mexican origin at all.

On page 75 the author reaffirms the view of Stevens, Bancroft, as well as his own, "that the Yucatan structures were built by the Mayas, the direct ancestors of the people found on the peninsula at the Conquest, and of the present native population.—*Amer. Naturalist.*

CHEMISTRY.

THE ARTIFICIAL FORMATION OF THE DIAMOND.*

BY J. B. HANNAY, F.R.S.., F.C.S.

While pursuing my researches into the solubility of solids in gases, I noticed that many bodies, such as silica, alumina, and oxide of zinc, which are insoluble in water at ordinary temperatures, dissolve to a very considerable extent when treated with water-gas at a very high pressure. It occurred to me that a solvent might be found for carbon; and, as gaseous solution nearly always yields crystal-

* A paper read before the Royal Society, February 26, 1880.

line solid on withdrawing the solvent or lowering its solvent power, it seemed probable that the carbon might be deposited in the crystalline state. After a large number of experiments, it was found that ordinary carbon, such as charcoal, lamp-black, or graphite, were not affected by the most probable solvents I could think of, chemical action taking the place of solution.

A curious reaction, however, was noticed, which seemed likely to yield carbon in the nascent state, and so allow of its being easily dissolved. When a gas containing carbon and hydrogen is heated under pressure in presence of certain metals, its hydrogen is attracted by the metal, and its carbon left free. This, as Prof. Stokes has suggested to me, may be explained by the discovery of Profs. Liveing and Dewar, that hydrogen has at very high temperatures a very strong affinity for certain metals, notably magnesium, forming extremely stable compounds therewith.

When the carbon is set free from the hydrocarbon in presence of a stable compound containing nitrogen, the whole being near a red-heat and under a very high pressure, the carbon is so acted upon by the nitrogen compound that it is obtained in the clear, transparent form of the diamond. The great difficulty lies in the construction of an inclosing vessel strong enough to withstand the enormous pressure and high temperature—tubes constructed on the gun-barrel principle (with a wrought-iron coil), of only half an inch bore and four inches external diameter, being torn open in nine cases out of ten.

The carbon obtained in the successful experiments is as hard as natural diamond, scratching all other crystals, and does not affect polarized light. I have obtained crystals with curved faces belonging to the octahedral form, and diamond is the only substance crystallizing in this manner. The crystals burn easily on thin platinum-foil over a good blow-pipe, and leave no residue, and, after two days' immersion in hydrofluoric acid, they show no sign of dissolving, even when boiled. On heating a splinter in the electric arc, it turned black—a very characteristic reaction of diamond.

Lastly, a little apparatus was constructed for effecting a combustion of the crystals and determining their composition. The ordinary organic analysis method was used, but the diamond crystals were laid on a thin piece of platinum-foil, and this was ignited by an electric current, and the combustion conducted in pure oxygen. The result obtained was, that the sample (14 m. grms.) contained 97.85 per cent of carbon—a very close approximation, considering the small quantity at my disposal. The apparatus and all analyses will be fully described in a future paper.

The specific gravity of the diamond I have obtained ranges as high as 3.5, this being determined by flotation, using a mixture of bromide and fluoride of arsenic.—*London Chemical News.*

DOMESTIC ILLUMINATION BY ELECTRICITY.

A French paper states that Dr. Phipson has proposed a new solution of the question relative to a cheap means of illumination for domestic purposes. He has succeeded in augmenting considerably, by means of a comparatively weak electric current, the phosphorescence of certain substances influenced by the solar rays. He incloses within a Geissler tube a phosphorescent substance, such as the sulphide of barium, and causes the tube to be traversed by a constant current of a certain intensity. By this means, it is stated, a uniform and agreeable light may be obtained at a less cost than by means of gas. The *Electrician* understands that Dr. Lyon Playfair has adopted the Jablochkoff system for partially lighting his own residence.

It is not surprising that barley, potatoes and many other plants and vegetables ripen in the most northern latitudes, seeing that they are exposed to a considerable amount of heat during two or three months of the year. In those regions where the sun hardly descends below the horizon in summer there is no night, only a short twilight; the growing plant, therefore, enjoys permanently, and without interruption, the heat and light which it requires.

One of the silk manufacturing firms of Lyons is introducing the production of photographic impressions on stuffs. They sent to a recent meeting of the Photographic Society several pieces of silk with a variety of photographic pictures printed thereon, including, among others, a number of large medallions representing pictures of the old masters. The length of the specimens thus exhibited is stated as being no less than 131 feet. The process by which they are produced is not given, but it is believed that the prints are made with salts of silver.

An ingenious and simple apparatus for making a bell ring at any predetermined hour of the day is described in a recent number of *L' Electricite*. It comprises a lens by means of which the solar rays are concentrated and directed on the metallic strip, which is susceptible of very rapid and great dilatations. The result of the dilatation is electric contact, giving passage to a battery current which rings the bell. Although the sun may be covered by clouds, its calorific power is never diminished so much as not to dilate the strip.

BOOK NOTICES.

THE NORTH AMERICANS OF ANTIQUITY—THEIR ORIGIN, MIGRATIONS, AND TYPE OF CIVILIZATION CONSIDERED. By John H. Short. Octavo, pp. 544. Harper & Brothers, New York, 1880. For sale by H. H. Shepard; $3.

The subject of American Archæology is one of growing interest and importance. Everywhere throughout the country new discoveries are being made, bringing to light traces of the ancient inhabitants of America and new material for their history. The work before us is one of the latest and best which has appeared on this subject. While of a necessity there is much that has appeared before in works of this character, there is also much that is new; and, although not professing to be an exhaustive history of the native races, like Bancroft's, it gives us a concise summary of all that is known to date in regard to the ancient inhabitants of America, with copious bibliographical references for the use of those who wish to examine for themselves the authorities quoted. Passing from the Mound Builders of the older States, he presents us with a full and comprehensive account of the new field of archæology lately opened up in Colorado—the Cliff Dwellers; and thence to Central America and Mexico. The chapters on the Mayas and Nahuas are especially interesting, presenting us with the latest discoveries in the ruined cities of this region, and the efforts made to decipher their hieroglyphics. Here is yet a grand field for discovery. While Waldeck, Dupaix, Stephens, and Squier have done good work in this region, they have but skimmed the surface, so to speak, and much yet remains for the enterprising traveler. Witness the tablets and splendid statue of Chac Mol, the Maya demi-god, exhumed by Dr. Le Plongeon and his wife, at Chichen-Itza, in Yucatan: "The statue represents the reclining figure of a man who is naked, except that he is adorned with a head-dress and bracelets and garters of feathers, and sandals similar to those found upon the mummies of the ancient Gananches of the Canary Islands."

This statue was seized by the Mexican officials and sent to the capital. Its exact duplicate was found some years later under the Plaza of the City of Mexicò, proving that the tribe whose king or god it was, must have migrated southward, as the one excavated in Mexico shows greater age than the one from Yucatan. Who are they, whence came they, and whither did they go? are the questions the traveler asks himself as he gazes upon the magnificent works of these people rising grand and lonely before him in the unbroken forests and on the wild headlands of the sea coast. Paintings and relievos, "worthy to be compared to the most beautiful works of the days of Augustus," adorn their inner walls, while sculptured façades, statues, towers and temples in bewildering confusion rival in their splendor and magnificence the works of ancient Egypt in her palmiest days. And yet—most tantalizing of all—these strange people have left their historical records behind them graven in imperishable stone, which, as yet, no one can decipher;

and the "stony-eyed statues" seem with a mocking smile to point the inquisitive traveler to the tablets in which they have locked up their secrets in undecipherable hieroglyphics. Many efforts have been made to read these characters, especially by the Abbè Brasseur de Bourbourg; but the results so far, to say the least, have been unreliable and unsatisfactory. As yet, no Rossetta stone has been found to give us a key to these ancient records.

The book is fully and judiciously illustrated, and the publishers have done their part in their usual excellent manner. L.

OUR HOMES. By Prof. Henry Hartshorne, A.M., M.D. Philadelphia: Presley Blakiston, 1880; 150 pp., 16mo; 50c.

This is by far the most important of the valuable and popular series of American Health Primers, now published by Presley Blakiston, who has succeeded Lindsay & Blakiston. The preceding numbers contained descriptions of and directions for the management of various diseases of the body, all of which are more or less dependent upon the hygienic condition of our homes. Certain it is that if our dwellings were constructed upon strict sanitary principles, our throats, lungs, ears, eyes, and even our brains, would be better guarded against disease than in any other way that can be devised. As is well known, more than half of the illness of the people is due to badly ventilated, imperfectly warmed and poorly lighted houses, while a great portion of the other half is attributable to foul drinking water and defective drainage; so that if the teachings of Dr. Hartshorne on these subjects be carefully heeded, we may almost expect to be free from most of the diseases so common in all families. If this book cost $5 instead of 50c, it would be cheap to any man about to build a family residence, either for himself or for rent.

ILLUSTRATED HISTORY OF ANCIENT LITERATURE. By John D. Quackenbos, A.M., M.D. Harper & Brothers, 1878; pp. 432, 12mo. For sale by W. H. V. Raymond, publishers' agent, Kansas City; $1.25.

This volume is intended as a text-book in the schools, but need not be necessarily regarded as a school book, since it will be found most valuable and interesting to the general reader and as a book of reference for the writer and student of larger growth. It presents a full account of the literatures of ancient nations, and, in treating of the origin and relationships of their respective languages, incidentally bring forward some of the most interesting facts of comparative Philology. While the works of the Greek and Roman writers are fully discussed, the principles of the Egyptian hieroglyphic writing are explained, and the vast treasures exhumed by recent explorers of the ruins of the valley of the Nile and elsewhere, are described and illustrated. No text-book that we have seen seems better calculated to arouse in the minds of students a love of literature and literary pursuits for their own sake, or of ancient history and philology as suggested subjects.

PREVENTION AMD CURE OF CHRONIC CONSUMPTION. By David Wark, M.D. New York, Authors' Publishing Co., 1880; 12mo, 103 pp.; 80c.

The author's theory is that the pulmonary congestion may be relieved by certain manipulations of the limbs and extremities which shall induce a flow of blood from the affected point to them, the patient to be entirely at rest and the manipulating performed by an attendant. This treatment, however, is not to be applied in lieu of medicines, but in connection with them. A number of cases, where beneficial results have followed this treatment, are reported, and the President of the Authors' Publishing Company himself voluntarily testifies to having been cured by adopting the treatment, while the book was in the hands of their "reader" and printer.

POPULAR ASTRONOMY. By Simon Newcomb, LL.D. Harper & Brothers, New York, 1880. Octavo, pp. 577. For sale by W. H. V. Raymond, publishers' agent, Kansas City; $1.30.

It is saying very little, considering the eminent ability and position of the author, to state that it is the best school astronomy we have ever seen, and probably the best ever published. Prof. Newcomb is Superintendent of the American Nautical Almanac, and formerly Professor at the United States Naval Observatory, and, of course, brings to his work a large experience and the latest possible results of astronomical research. Beginning with the work of the ancient astronomers of Egypt, Chaldea and Greece, he gives a complete summary of the progress in discovery and invention down to the present day, the whole being written in a clear and simple style, alike attractive and instructive to the student and the general reader.

The work is illustrated with 112 engravings and five maps of the stars, and is just such a work as every intelligent reader, not a professional investigator, will be gratified to have at hand.

ROMAN CATHOLICISM IN THE UNITED STATES. Anonymous. Authors' Publishing Co., New York, 1879; 12mo, 190 pp.; $1.25.

We quote as follows from the prospectus, only suggesting that, so far as we can judge, the subject is treated candidly and plainly. The mechanical work is first-class—creditable to the publishers in every respect:

"The author of this book is the author of several well-known thoughtful works. He withholds his name from this simply that its spirit of impartiality and unwavering fairness may not suffer by prejudgment. He treats his subject with persistent candor and rigid honesty. He minces nothing and omits nothing for want of frankness which either the subject or argument involves. He lays hold of a stupendous theme, and treats it manfully. He plays with nothing. His style is simple and direct. His logic is gigantic, if indeed it be not absolutely invincible.

"The year—and possibly the decade—has not produced a more important work. With almost equal certainty, it has not produced one that is better written. These are strong assertions, but they are carefully, cautiously made. The book will more than sustain them."

THE TAXIDERMIST'S MANUAL. By Capt. Thomas Brown, F.L.S., London, England. G. P. Putnam's Sons, New York, 1879 For sale by M. H. Dickson; $1.25.

To every casual observer of zoölogical specimens, as found in the average museums, it would certainly seem that so good a book as this had never been written, much less that it had reached its twenty-eighth edition; while to one well acquainted with the appearance and habits of the living creatures themselves these miserable travesty of nature suggest that the manipulator not only never had read a book on the subject, but had lived with his eyes shut and made up the specimens solely by the guidance of a distorted imagination.

Not only will this work be found a guide to taxidermists in making life-like preparations, but also in all the details of tools, materials, preservatives, and handling of birds and mammals, as well as shells, insects, fishes and reptiles. The writer has had an abundant and varied experience, which has enabled him to appreciate and meet the learner's wants; and this, in our judgment, he has well done. The engravings seem to be just what the beginner will need to give him the proper start in the work, and the descriptions are clear and precise.

OTHER PUBLICATIONS RECEIVED.

Introduction to the study of Sign Language among the North American Indians by Lieutenant Col. Garrick Mallory, U. S. A.; The Approximate Solution of Kepler's Problem, by H. A. Howe, A. M., Cincinnati Observatory; On the Extra-Meridian Determination of Time, by means of a portable transit instrument, by Ormond Stone, A. M., Astronomer at the Cincinnati Observatory. The Kansas Review, Lawrence, March '80, monthly, 75cts. National Journal of Education, Boston and Chicago, weekly, $3.00. Quarterly Report of the Kansas Agricultural Board, 1879, J. K. Hudson, Secretary. Le Technologiste, 40th volume, weekly, 25 francs per annum. Johns Hopkins University Circulars Feb., 1880. The Conservative, monthly, March, 1880. The Oriental and Biblical Journal, Clinton, Wis., quarterly, $2.00. Second annual Report of the State Board of Health of Colorado. National Literary Monthly, Toledo, Ohio, March, 1880, $1.50.

SCIENTIFIC MISCELLANY.

A STEAM ROAD WAGON.

During the winter months Prof. Saroni has been busy in perfecting his steam wagon, and he will this week forward his model of the machinery to Washington, D. C., for the purpose of securing letters patent on it, he having so far been operating under a simple caveat. Since the appearance of the apparatus upon the streets last fall it has been vastly improved. By a double system of clutches and pulleys, one at each end of the driving shaft, the power can be applied for speed or for slow work with heavy draught. But the greatest novelty that has been introduced into the machinery is a system of propulsion for use in case of ascending a steep hill. Taking an idea from the fact that a horse can draw a much heavier load than its own weight, the inventor has introduced two sets of levers that correspond exactly in movement and in the application of power with the two hind legs of horses, the one alternating with the other, precisely as do the limbs of the animal. It is difficult, without diagrams, to illustrate how this is accomplished, but its effect can be understood with sufficient clearness from the foregoing comparison. The second important advance made is in a device for the rapid generation of steam, which is a marvel of ingenuity, as well as a marvel of success. As formerly, gasoline is the fuel employed, and the flame is made to play upon pumice stone, which heats to a whiteness, and thus not only creates a reservoir of constant heat, but should the flame be temporarily extinguished by a sudden jerk of the machinery, as it is apt to be, it is instantly rekindled. The pumice stone occupies the fire box, above which are arranged coils of pipe containing the water, which are so arranged as to give the water both lateral and longitudinal motion, and to permit the sediment to settle in the lower pipes on the side of the fire-box, where it can be readily taken out. A second and smaller boiler is used to generate steam first, and this superheated steam is conducted to a nozzle, at the end of which and below it is placed a second nozzle. This portion of the apparatus is similar to the atomizers which are so familiarly known and used in procuring fine spray from bottles of perfume, and the action of the steam atomizer invented by Prof. Saroni, is precisely similer to that of a perfume bottle. The jet of superheated steam, as it emerges from the nozzle immediately below the steam nozzle, and steam and gas are together projected into the fire-box in that infinitely divided condition so favorable to chemical combination, resulting in intense combustion and the rapid production of heat. As soon as the pumice-stone has thus been sufficiently heated, the atomizers are shut off and the ordinary service jets are turned on. By this means steam can be generated from cold water to a pressure of 100 pounds in four

minutes. It may be added that the "leg propulsion," if it may be so te[illegible] can be used with or without the slow-motion pulley, or the locomotive app[illegible] may be entirely uncoupled, and the power applied to driving a threshing [illegible]chine, with the wagon remaining stationary.—*Pioneer Press.*

A NEW WAY OF STUDYING SOUNDS.

The London *Times* reports that a new and simple way of producing co[illegible] rings, which seems capable of some interesting applications, has been rec[illegible] brought to public notice by M. Gebhard. A saucer filled with not very p[illegible] mercury is all the apparatus required. Then clear off with a piece of paper [illegible] thin pellicle of oxide and dust, breathe on the bright surface, and a magnific[illegible] system of colored rings is given by the film of condensed moisture then form[illegible] Instead of the four or five "irises" described by Newton, six or seven ca[illegible] well made out, and the thickness of the film increasing from the borders inwa[illegible] the order of hues is reversed. Still better effects can be got by dropping vola[illegible] substances (as petroleum oil) on the mercury surface, instead of breathing o[illegible] but the most remarkable results are made with the collodion. Diluted with eth[illegible] this gives pellicles on the mercury, which may be detached (after their thickn[illegible] and colors have been regulated at will) and transferred to paper. M. Gebha[illegible] has utilized these effects in study of the sounds of the voice. Vocal sounds [illegible]terred above the moistened mercury surface produce characteristic ring figur[illegible] which throw new light on the nature of the vibrations involved. The vibrat[illegible] state, indeed, few vowel sounds, appears to be very complex, the figures pr[illegible]senting groups of several ring systems, including several centers of percuss[illegible]

THE MAGNET IN MILLING.

Magnets and magnetic separators are a comparatively new thing in milling but perhaps there is no contrivance imployed in our mills whose utility is so un[illegible]questioned, or which has grown into such wide use in so short a time, as the magnet in the forms of gangs and separators. Many who at first sight saw nothing objectionable in wire-bound wheat, were soon loudest in their clamors against it. They had relied upon cleaning machinery of unquestioned excel[illegible]lence to remove what bits of wire should chance to find their way in to the wheat; but time soon showed that the crooked little pieces of wire would work their way through the cleaning machinery, thence go to the buhrs, where they were flattened out into saws, and then to the bolts, where they played havoc with the cloth. In some sections where the wire binder was exclusively used, bits of wire could be traced even into the bread, and be found in an incomprehensible abundance in mill products. It got into the bran and choked cattle fed on it

It blackened the buhrs and destroyed the bolting cloths. In fact, wire in wheat became an unbearable nuisance in spite of every precaution against it—and then came the magnet.

Never did so simple a remedy cure such widespread dissatisfaction. Millers' associations had tabooed the wire-binder and passed resolutions favoring a discrimination in price against wire-bound wheat. This journal had declaimed against it until it felt hoarse; but the magnet removed every objection to the wire-binder by taking out the insidious bits of wire. Every miller who tried the remedy was satisfied, and the clamor ceased. The truth is, that the introduction of magnets as a grain cleaning agency opened the eyes of millers to a few facts of which they had been ignorant before. Most of us knew that the magnets would show that wire existed where its presence was never suspected; but who would have looked for such a collection of metallic odds and ends as these separators bring to light? In the course of a day a large merchant mill will take from its wheat, by means of magnets, a miniature junk shop. You will find everything represented, from ten-penny nails down to bits of iron as small as a pin head. How all of it got into the wheat is a mystery; but one thing is certain, that much of this iron must formerly have gone to the buhrs and bolts; and, even if the wire-binder had never been invented, magnetic separators would find a useful place in every mill.—*American Miller.*

EDITORIAL NOTES.

THE present number concludes the third volume of the REVIEW, and again our thanks are due to the generous patrons at home and abroad who have aided in supporting it. Its field of usefulness has been materially extended during the past year through the enlightened liberality of appreciating friends, so that it has found its way to nearly every portion of the globe, and, from the words of approval that have reached us from many highly esteemed literary and scientific gentlemen, far and near, we draw the gratifying conclusion that its editorial management has been successful. This alone is sufficient to encourage us to continue its publication and to give to its improvement in every respect, increased effort; for while we naturally desire to have the REVIEW self-supporting, it must be very clear to everybody that there can be no pecuniary profit resulting from it. To achieve in so short a time, the prominent position among the periodicals of the day which is accorded to it, is remarkable, and is of course attributable to the excellent quality of the articles contributed to its pages and the diversity and appropriateness of the subjects discussed.

ON Thursday, Friday and Saturday, March 25th, 26th and 27th, a wind storm raged through the West and Southwest, extending from Texas across Kansas and Missouri, over a track from fifty to 200 miles in width, into Illinois, doing considerable damage to buildings, fences, etc. Winfield, Kansas, seems to have been the greatest sufferer, a number of buildings having been destroyed and several persons seriously injured.

Observations taken by Sergeant Weber at the Signal Service Office shows St. Louis to have been near the center of a very low at-

mospheric pressure, the barometer in Texas indicating one inch higher.

The St. Louis *Globe-Democrat* says:

Since the establishing of the Signal Service Station at this city there have been but two such storms of wind experienced, the first on the 18th of May, 1878, when the wind attained a similar velocity, and on the 4th of August, 1878, when a gale traversed the city at the rate of seventy-two miles per hour.

The average velocity of the storm of the 27th, from 6 a. m. to 12 m., was thirty-eight miles per hour, and while at its maximum force the pressure was sixteen pounds to the square foot.

At Leavenworth the maximum velocity of the wind was thirty-six miles per hour, and the average for thirty-four hours was 25.2 miles per hour. Here at Kansas City it was less than half as great for the same time.

PREMIUMS TO SUBSCRIBERS.

We again call attention to the plan which has proved so appropria'e and acceptable for giving premiums to our subscribers for the last two years, viz:

To any person who sends us $3.50 we will send the REVIEW, for one year, and any $1.50 book published by D. Appleton & Co., S. C. Griggs & Co., Robert Clarke & Co., Houghton, Osgood & Co., Roberts Brothers, J. B. Lippincott & Co., John Wiley & Sons, Henry C. Lea, S. R. Wells & Co., Ivison, Blakeman, Taylor & Co., Harper & Bros., or Orange Judd & Co.

To any one sending us $3.75, we will send the REVIEW for one year and any $2.00 book published by any of the above firms.

Persons desiring to subscribe for the REVIEW and purchase any book or books, or subscribe for any other periodical, published or attainable in this country, can obtain special rates by applying to the editor in person or by letter.

Clubs desirous of subscribing for the REVIEW can have the same privilege as single individuals, besides the advantage of reduced rates of subscription.

To persons wishing to purchase law, medical, scientific or miscellaneous books, and at the same time subscribe for a periodical which includes within its scope popular articles upon all branches of science, mechanic arts and literature, we deem this a particularly favorable offer.

THE astronomical lecture of Prof. Proctor, of London, before the Kansas City Academy of Science, on the 26th ult., was extremely interesting, and would have been very largely attended except for an unfortunate rain storm just at the hour of commencement, which kept hundreds away.

The skillful management of the oxy-hydrogen light by Prof. E. C. Crosby, of this city, contributed largely to the success of the entertainment.

The lecture of Judge Arnold Krekel before the Academy on Tuesday evening, March 30, was a concise history and masterly exposition of the "Monroe Doctrine" from the earlier days of the Republic down to the present time, and was listened to with marked attention by a full house.

THE annual commencement exercises of the Kansas City College of Physicians and Surgeons, on March 2, attracted a large audience, which was well entertained by Rev. Dr. Bell, J. V. C. Karnes, Esq., Prof. Geo. Halley, and Mr. Schenck who delivered the class valedictory. The regular prizes all fell to students from Kansas this year. The standard of excellence fixed by this institution for graduates is unusually high, which is not only creditable to it at present, but will insure good returns in the future.

WITH no disposition to boast, but merely for the purpose of showing concisely what we have done in the past year, we will say that there have appeared in the REVIEW no less than one hundred and eighty articles expressly written for or contributed to it, classified under the various heads of Geography, Anthropology, Astronomy, Geology and Palæontology, Foreign and Domestic correspondence, Meteorology, Mining and Metallurgy, Book notices, Chemistry, Botany, Archæology, Physics, Evolution, Political

Science, Reports of Proceedings of Societies, Medicine and Hygiene, Ornithology, Necrology, Technology, Engineering, Education, etc.

In addition to all this, Selections on all these topics and many more have been republished from the leading scientific journals of the world; while the Editorial Notes have been intended as a running commentary upon current scientific discoveries, natural phenomena, notable magazine articles, etc.

In short, we believe we do not exaggerate when we say that the three volumes of the REVIEW will compare favorably in point of popular interest and reliable, useful information, with any similar periodical of the country, and for proof of this we refer our readers to the index which accompanies this number.

THE Merchants' Exchange of St. Louis, on the 8th of March, passed a series of resolutions relative to the Signal Service of the United States, in which they express their appreciation of the incalculable advantages and benefits in everything connected with the vast commercial and industrial interests of the Mississippi Valley derived by the merchants of that city from it, speak in the highest terms of commendation of the successful labors of Gen. Myer and his assistants, and recommend that his suggestions for its improvement and extension be favorably received by Congress.

MR. JOSEPH SAVAGE, Secretary of the Mudge Monument Fund, reports that between two and three hundred dollars have been raised or pledged for that fund already.

WE are occasionally obliged to decline a valuable article on account of its exclusively technical character, and we take this occasion to repeat what we have said before, that the main object of the REVIEW is to entertain and instruct by means of popular articles rather than to offer problems in science, adapted to profound students, and which the majority of our readers, being professional men and merchants, have neither time nor inclination to work out. To this cause more than to anything else we attribute the increased circulation of the REVIEW in this busy city and it will be our constant object to make it more and more popular with every succeeding issue.

THE very heavy rain storm of Friday night, March 26, was followed on the next day by a very heavy west wind and an intensely and peculiarly hazy appearance of the sky, almost like a partial eclipse of the sun; which gave rise to all kinds of speculations on the part of observers, the trees, houses and fences being whitened as with frost, though the mercury stood at 55°. It was finally decided to be caused by vast quantities of fine sand or dust, carried along in the atmosphere, and it was still later discovered that it had been borne by the wind from beyond the limits of the rain storm, which extended north and west a distance of nearly 100 miles.

ON April 13, Rev. Richard Cordley, D.D., of Emporia, Kansas, one of the ablest divines of the State, as well as one of the most interesting speakers, will deliver the sixth lecture of the extra winter course before the Kansas City Academy of Science, upon the subject of Patience in Culture and Investigation. These lectures have given excellent satisfaction to our people so far, and this one will prove no exception to the rule.

THE election of Major J. K. Hudson to the position of Secretary of the Kansas State Board of Agriculture, to succeed the late Alfred Gray, insures, in our opinion, an intelligent, active continuation of the plan of State development so admirably inaugurated and so successfully conducted by the latter during the past ten years.

WE have received from the Graphic Co., of New York, some samples of their reproductions in photo-lithography, of steel engravings, which approximate very closely to the originals themselves; yet they are printed on first-class paper, sold and forwarded post paid, for about one-tenth of the price.

PROF. J. S. E. DREYER, of the Royal Dublin Astronomical Society, writes thus pleasantly of the REVIEW:

"I have read a great many of the articles with the greatest pleasure, and hope you will be kind enough to send me the remaining numbers of the volume, as I would like to have it complete and get it bound."

OUR grateful thanks are due to our exchanges, both in this country and Europe, for uniform courtesy and frequent complimentary notices, and, more than all, for the appreciation of our articles manifested by their reprinting many of them on both sides of the Atlantic. These favors we attempt, as far as our space will permit, to repay in kind whenever opportunity occurs.

ALL persons desiring to have their back numbers of the REVIEW bound, as heretofore, in morocco backs and cloth sides, can have it done for $1.00 per volume of twelve numbers, by leaving them with the editor or at the office of Messrs. Ramsey, Millett & Hudson, 224 and 226 West Fifth street.

The back numbers of the first and second volumes will be furnished at *half price* i. e. $1.25 per volume of twelve numbers, or $2.25 per volume, bound as above. *The back numbers of the third volume,* being quite scarce, can only be furnished at the *regular rates.*

ITEMS FROM THE PERIODICALS.

VAN NOSTRAND'S Magazine for April presents in its table of contents articles upon Retaining Walls, by Wm. Cain, C. E, (Illustrated); Compound Armor; The Absolute Zero of temperature, By J. F. Klein, D. E.; Dwelling Houses: Their Sanitary Construction and Arrangements, by Prof. W. H. Corfield, M. A., M. D., (Oxon) II; Bridging Navigable Waters of the United States, Report of Gen. G. K. Warren; The Nature of Electricity; The Panama Canal, by Captain Bedford Pim, R. N., M. P., parts II and III; The Measurement of Earthwork by the Prismoidal formula, by C. P. Aylen, B. C. E.; On the Hardening, Tempering and Annealing of Steel; Engineering Progress During the Last Fifty Years; address of William Henry Barlow, Esq., F. R. S.; Dynamo-Electric Machines, I. (Illustrated), and Editorial Notes.

GOOD COMPANY (Number seven) gives its usual quota of attractive and readable sketches, among which are an account by Charles Dudley Warner of a twenty-four hour expedition by "the Chaplain," "Old Phelps," the well known Adirondack guide, and himself, over an Adirondack mountain near Keene Flats; a tale of the South Pacific, by Edward Bellamy; and Through a Needle's Eye, by Katharine Carrington; An Idyl of New Mexico; Barberry Island; Modern Pictures from Italy; Father Quinnailon's Convert, by Octave Thanet; John Burroughs' Foot Paths, and Winter Greens, by E. S. Gilbert. Geo. M. Towle sketches John Bright; and Mrs. Wager-Fisher tells of Earnest Renan. The other articles include Wanted, by Mrs. Edward Ashley Walker; The Defense of Criminals; Some Frontier Art; besides poems, redolent of Spring, entitled Fairfield's Brook, Tokens and Altar Blossoms.

This number opens a new volume, which is published at $3.00 a year, in Springfield, Mass.

THE *American Entomologist,* from which we culled the very life-like article in our March number entitled Zoölogizing in Mammoth Caves, has in its April number, among many other appropriate articles, a very suggestive one by Edouard Perris, upon the relative usefulness to the farmer, of birds and insects, a question which perhaps has received less discriminating attention than almost any of equal importance.

THE *Farm,* a prominent agricultural and horticultural paper of Ireland, published in Dublin, and to which we are indebted for an exchange, has removed from 34 Dawson st., to 87 Marlboro' st. It will in future be under the editorial management of Thomas B.

ant, for many years co-editor of the *Irish* *rmers' Gazette.*

Golden Days. Under this title, Mr. James rerson, of Philadelphia, has commenced e publication of a paper for boys and girls, hich aims to win them away from corrupt-g literature by furnishing them an antidote the form of good, wholesome and cheap ading, presented in its most attractive rm. This is a most praiseworthy object id purpose, and we hope that his success ill be commensurate with his conscientious forts in this direction.

The North American Review for April has r its leading article a paper intended to vin-icate General McClellan against the charge at he was over cautious and unnecessarily low in his movements, and contains many tatements of an interesting character. Sir 'rancis Hincks contributes a paper on the Relations of Canada with the United States. The Rev. David Swing writes about The 'ailure of the Southern Pulpit. The discus-ion of the Third Term question, begun in 'ebruary number of the Review, is contin-ued in the present number by the Hon. Geo. S. Boutwell. Charles Stewart Parnell sets orth the reforms in the laws of land tenure which are advocated by himself and his po-itical associates, under the heading, The Irish Land Question. The Book Notices are by Mr. Edward Cary.

THE *Oriental and Biblical Journal* is a quarterly magazine of handsome appearance, published by Jameson & Morse, 104 Clarke St., Chicago, Ill., and edited by Rev. S D. Peet, Clinton, Wis. $2.00 per annum.

The object of this magazine is to give the results of the researches in Archæology in all Eastern lands, and to present the various phases of thought which may arise from Ori-ental studies, especially as they bear on the sacred Scriptures, Rev. Selah Merrill, D. D.; Rev. Howard Crosby, D. D.; Rev. Lyman Abbott, D. D.; Rev. A. H. Sayce, F. R. S.; Rev. J. O. Payne, D. D.; Rev. James Strong, D. D, contributors.

THE April number of the *Popular Science Monthly*, in the variety, readableness, and substantial excellence of its articles, well sus-tains its reputation. Its contents are as fol-lows: Progress and Poverty, by C. M. Lungren; What is Jupiter Doing? (illus-trated), by Henry J. Slack; The Scientific Aspect of "Free-Will," by Albert J. Leffing-well, M.D.; Experimental Legislation, by Prof. W. Stanley Jevons; Curious Ways of Getting Food (illustrated), by Herman L. Fairchild; The Pleasure of Visual Form (I.), by James Sully; The Crayfish (illustrated), by Prof. E. Ray Lankester; Learning to Write; A Consideration of Suicide, by J. H. Hopkins; Vegetable Phosphorescence, by Ellen Prescott; Croll's "Climate and Time," by W. J. McGee; A Living Honeycomb; Size of Brain and Size of Body, by H. W. B.; The Textile Plants of the World; Sketch of Dr. Charles F. Chandler (with portrait); Correspondence, Editor's Table, Literary Notices, Popular Miscellany, Notes.

THE April numbers of *Harper's Monthly*, *Appleton's Journal*, the *Atlantic*, the *American Naturalist*, the *Phrenological Journal*, Boston *Journal of Chemistry*, etc., etc., have all been received, and all seem to greet the return of spring with especially appropriate and at-tractive articles.

Le Technologiste, edited by M. Louis Lock-ert, 35 Rue Oberkamp, Paris, is now in its fortieth year, and is consequently one of the oldest as well as ablest technical publications of France. Published weekly, 25 francs per annum.

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EDITED BY

THEO. S. CASE.

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